

# AUTOMOTIVE INDUSTRIES

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JULY 3, 1937

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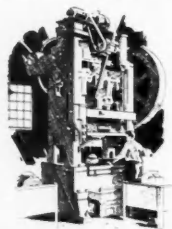
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**STANDARD OIL COMPANY**  
(INDIANA)

# AUTOMOTIVE INDUSTRIES

## AUTOMOBILE

Reg. U. S. Pat. Off.  
Published Weekly

Volume 77

Number 1

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Cable Address ..... Autoland, Philadelphia

**SUBSCRIPTION RATES:** United States, United States Possessions, and all countries in the Postal Union, \$1.00 per year; Canada and Foreign, \$2.00 per year. Single Copies this issue, 25c.

Member of the Audit Bureau of Circulations  
Member Associated Business Papers, Inc.

Entered as second-class matter Oct. 1, 1925, at the post office at Philadelphia, Pa., under the Act of March 3, 1879.  
Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903, the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by



**CHILTON COMPANY**  
(Incorporated)

Executive Offices

Chestnut and 56th Streets, Philadelphia, Pa., U. S. A.

Officers and Directors

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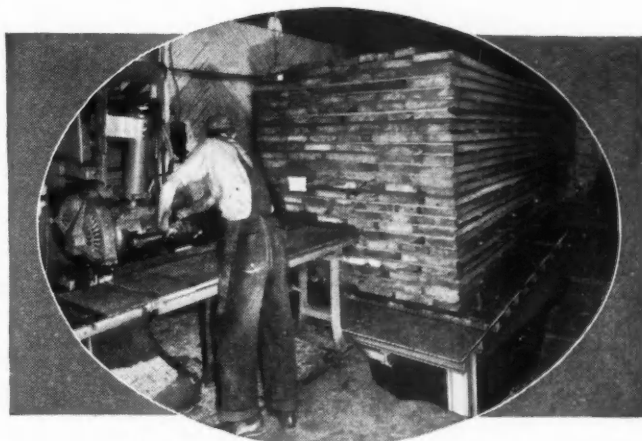
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July 3, 1937



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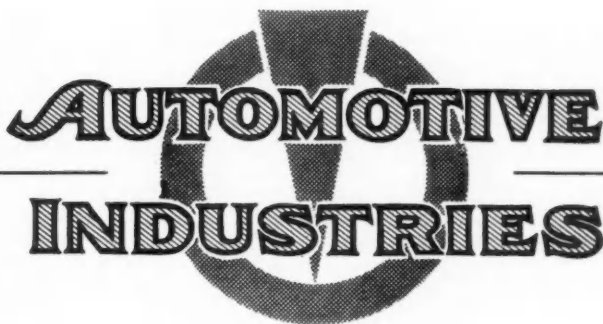
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July 3, 1937

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*Automotive Industries*





### As It Looks Now . . .

A number of 1938 models will have entirely new bodies, this especially true of certain higher priced makes, the less expensive series of which were restyled for 1937 . . . Visibility will be greatly improved through the use of narrower pillars and better front seat placement . . . Trim and concealed construction items will be better . . .

Important changes will be seen in transmissions, Oldsmobile having given a tip with its recent announcement of optional automatic equipment on the 1937 eight . . . Hypoids and two-speed rear axles will be more common . . .

At least two manufacturers will change rear springing quite radically, but neither will go to independent suspension all around . . . One will have coil springs at each corner . . . The other will use special leaf springs.

Detail improvements in engines will be made to raise performance and economy standards . . . More aluminum pistons and more tin plating will be seen . . .

Steering will be further improved to eliminate wander at high speeds . . .

More batteries will be relocated under the hoods with at least one change in shape to a long and thin package . . .

## 1938 Car Design Trend Emerges

### Major Mechanical Changes Comparatively Few But Bodies and Running Gear Will Be Widely Improved

Survey of 1938 automobile design in Detroit indicates that comparatively few major engineering developments will mark the change from 1937 to 1938 models, but that considerable alteration in bodies will be seen from the point of view of appearance and structural details. There will be new transmissions and new springing in several cars. There will not, so far as can be reported now, be a volume-production car with independent springing all around.

Safety and comfort will be body features. Safety will be achieved to an even greater degree than at present by improving visibility. Wider windshield openings, narrower pillars and better

front seat location will make their appearance.

The first announcement of the 1938 season will perhaps be the Hupmobile line of sixes and eights. These cars are in the modern style and feature new bodies made from new tools. The bodies are wider, longer, and roomier than anything attempted before in the Hupp organization.

A number of important makes will have entirely new bodies.

One of the large production organizations says that more and more intensive research is going into the mechanical elements of the body, making this activity a field quite apart from pure styling. This program takes all the guess work out of parts such as hinges, locks, dovetail window regulators, seat springs, etc. More die-cast grilles will be seen.

Plastics are really coming into their own this season. Instrument boards will be larger and instruments closer grouped, in general, to provide better visibility. Hupmobile has three plastic sections which practically cover the entire instrument board. Plastics also will be found on some ornaments in combination with zinc die castings.

Edge-lighted instruments have proved so popular and so effective that their use will be extended rather widely.

The Oldsmobile automatic safety transmission is the forerunner of many new things that are believed to be on

(Turn to page 29, please)

## Industry Ahead of 1937 Schedule

### Produces 58 P. C. of Projected 5,000,000 Units in Six Months; July Output to be Large; Sales Begin Summer Dip

With a total of more than 2,900,000 cars and trucks built in the first six months of 1937, the automobile industry has come 58 per cent of the way toward its goal of 5,000,000 units which is the commonly accepted projection for 1937. This may be considered slightly in excess of its quota for the first six months, since in the corresponding periods of 1935 and 1936, the two other years with new model introductions in the fall, the half year accounted for 56.5 per cent and 56.2 per cent, respectively, of the full year's output. If the same ratio holds for the current year, 1937 production will be about 5,150,000 vehicles.

The industry goes into July with schedules that indicate fully as big an output as in July last year when 451,474 units were built, and it is not unlikely that the current month may run slightly higher.

Labor troubles have subsided considerably in the last two weeks. The approaching summer shut-downs as well as a stricter attitude toward discipline on the part of union leaders are making stoppages of work less popular. Some of the leading producers

are holding to their June schedules this month and others who missed their marks last month are planning to run heavier than in June. There are, of course, some who are easing off.

The biggest loss to July output will come from the Ford closing on the 16th. This is the usual summer shut-down for inventory and vacations. It will give Ford only nine working days this

(Turn to page 31, please)

## This Week

**NEWS** includes an advance report from Detroit on what will be new in the 1938 automobiles . . . A description of the latest Diamond T model . . . Production situation and outlook . . . Developments on the labor front . . . Story on the record-breaking speeds achieved in time trials at Roosevelt Raceway . . . Authentic report on what happened to automotive plants during the sit down strikes.

**FEATURES** include a detailed and illustrated description of the Pratt & Whitney aircraft engine plant where precision manufacture is the by-word . . . An article on the operations taking place at the Cummins Diesel engine plant . . . Engineering drawing of the Hercules 6 cyl. engine.

## Decentralization Hits Akron

*Removal of Many Tire Operations to Other Cities Leaves  
Erstwhile Sit-Down Strikers Much Perturbed*

The spectre of decentralization was at last caught up with the tire industry and 40,000 tire builders in the Akron area who set the sit-down strike vogue are wondering what to do about it. With thousands facing layoffs as the industry begins to reduce its Akron production schedules, these tire builders are starting to take votes in the hopes that they can persuade manufacturers to adopt "share the work" programs instead of layoffs or furloughs. Akron area output will probably fall 20 per cent in July from June, and more in August.

At Goodyear where layoffs of more than 2500 men impends between now and Fall, members of the United Rubber Workers of America, CIO affiliate, have voted overwhelmingly in favor of a "share the work" program which will be submitted to the company. Goodyear's new plant in Jackson, Mich., soon will be making 6000 tires a day. Production facilities have also been increased at Gadsden, Ala.; Cumberland, Md., and Los Angeles, which means that if the 2500 or more should be laid off in Akron, the layoffs would be permanent.

Employees of other Akron companies face similar problems. Goodrich, it is reported, faces the necessity of laying off of at least 2000 employees in the next six months. Goodrich is now making 5000 original equipment tires a day at Oaks, Pa., which used to be a reclaiming plant and is getting another plant into operation at Cadillac, Mich.

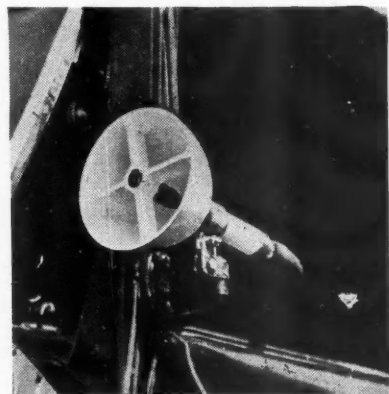
It is understood that fully 1000 of the 10,000 Firestone workers thrown out of work for eight weeks by the recent CIO strike, have never been taken back and probably never will be. Firestone is increasing production rapidly in its new plant in Memphis, Tenn., and faces the necessity for further Akron layoffs as soon as its new rim plant is in

operation at Riverview, Mich.

On top of all this, the minute the new Ford tire plant at Dearborn, Mich., gets into operation, with a potential capacity of from 18,000 tires a day, schedules of Akron manufacturers who have been supplying Ford will be further cut since they will lose at least part of their shares of the Ford original equipment business. This will effect Goodyear and Goodrich far more than Firestone.

General Tire & Rubber Co. is operating its new branch plant at Wabash, Ind., and, dependent upon the labor Situation, may or may not build a branch tire factory in Virginia.

Replacement sales, which were extremely low in April and May, have shown some recovery so far in June but the industry as a whole is still heavily overstocked and current heavy



European

### PASSING SIGNAL

designed to eliminate danger when overtaking vision-blocking trucks. It was developed in Germany. Note emitted by air pressure is inaudible to the human ear but is received by equipment on the truck.

inventories must be liquidated down to a better balance before production can go ahead on any progressive scale.

## Raceway Time Trial Speeds Soar

*Remodeled Long Island Track Permits Fast Stretch Runs;  
Foreign Car Tops 85 M.P.H. on Twisting Circuit*

New speed records for the revamped Roosevelt Raceway, Westbury, Long Island, N. Y., were set in the qualifying trials for the 300-mile Vanderbilt Cup Race scheduled for July 3. Foreign drivers testing their road-racing cars not only flashed through the long straightaway in front of the stands at speeds ranging from 135 to over 158 m.p.h., but also set up new lap records over 85 m.p.h. In the first race on the track last fall, before nine of its original 16 curves were eliminated, the average speed was 65.996 m.p.h. Some of the American cars entered were nearly as fast for full laps but could not match the best stretch speeds.

Fastest time up to Thursday evening

was made by Bernd Rosemeyer, Germany, in an Auto Union rear-engined 16 cylinder car. He covered a 10-mile qualifying run at 85.235 m.p.h. with one lap of the 3 1/3-mile track turned at 85.886 m.p.h. Rosemeyer, testing earlier in the week, ran through the straightaway at 158.3 m.p.h. Banking of the final curve into the stretch has lifted speeds decidedly.

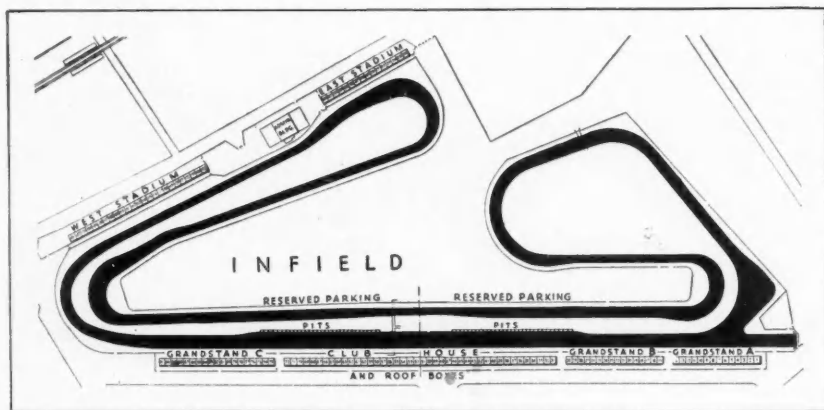
Rosemeyer's times were closely approximated by Rex Mays, Los Angeles, who set a lap mark of 84.698 m.p.h. His final ten miles was done at 81.346 m.p.h. Stretch speed was 141.3 m.p.h. He drove an Alfa Romeo. Tazio Nuvolari, winner of the first race at the track last fall, drove his 12 cylinder Alfa Romeo in a qualifying trial at 83.047 m.p.h. with a best lap of 83.560 m.p.h. His car appeared easier to handle on the turns enabling him to pick up speed on Rosemeyer. Nuvolari reached 138.5 m.p.h. on the straightaway.

Bill Cummings, driving a Burd Piston Ring Special, averaged 77.470 m.p.h. for 30 miles of qualifying runs.

### Agree on "Ad" Changes

The Federal Trade Commission announced that it has secured stipulations from seven automobile companies that they will cease using certain advertising representations in connection with the sale of passenger cars which may mislead the purchasing public. The companies said in the stipulations that they have already discontinued the use of the advertising in question.

The representations to which the commission objected were those in which cars were pictured equipped with



**SHARP CURVES** still are the feature of Roosevelt Raceway, Westbury, Long Island, N. Y., as this map of the rearranged track shows. Nine of its original 16 curves have been taken out

since the first race over the track last Fall. The curve into the main straightaway in front of the grandstands has been banked and has already permitted record speeds in time trials.

accessories, and in which the large-type selling price actually was less than the price of the car complete as shown. Elsewhere in the advertisement in smaller type were such statements as "f.o.b. Detroit" and "equipment extra."

Companies signing the stipulations were Hudson Motor Car Co., Graham-Paige Motors Corp., Studebaker Corp. and Studebaker Sales Corp. of America, Chrysler Corp., Nash-Kelvinator Corp., Packard Motor Car Co. and Auburn Automobile Co. The Chrysler stipulation was also signed by its subsidiaries, the Chrysler Sales Corp. and DeSoto, Dodge Bros. and Plymouth corporations.

## GM Insists on Wildcat Strike Ban

*Prefaces UAW Contract Talks With Demand; Ford Almanac Hits Labor Agreements; To Answer NLRB July 6*

General Motors Corp. informed the United Automobile Workers on June 29 that it would go no further on negotiations for a new contract until the union agreed upon specific punishment for members who instigate "wildcat" or unauthorized strikes. Homer Martin, UAW president, took the position that this demand on the part of the automobile company should be negotiated as any other change in the terms of the contract and said the union would not make any such promise prior to the opening of the joint conferences. Mr. Martin added, however, that the union is determined to prevent unauthorized stoppages of work. He said the joint conferences are now expected to begin early in the week beginning July 5. Any contract amendments are to become effective Aug. 11.

The executive committee of the UAW has been holding secret sessions in Detroit this week, studying reports on outlaw strikes in General Motors plants and factional disputes in the Briggs local.

The July issue of the *Ford Almanac* said, this week, "The next step in the game of the financiers will be wage standardization.

"All plants of the same kind will pay the same wages.

"The skilled worker will have lost the benefit of his skill—because he will have no market where he can sell it for a price higher than that named by the wage dictator."

Hearing on the complaint against the Ford Motor Co. by the National Labor Relations Board charging unfair labor practices in violation of the Wagner Act is scheduled for July 6 in the Federal Building, Detroit.

The complaint, issued June 26, covers nine pages and was based on charges made by the UAW following the forcible ejection of UAW organizers from Ford property May 26 when they attempted to distribute union literature.

A general denial of the charges was made by Louis J. Colombo, attorney for the company. He is preparing a formal answer to the complaint.

## See Higher Tool Prices

Machine tool prices are bound to keep advancing during the near future according to a survey in Cleveland.

The National Machine Tool Association claims no knowledge of any rumored general sharp increase.

Manufacturers, however, point to increased material and labor costs and conclude that the only way these can be met is by price increases. Deliveries are down at the present time.

Several of the larger makers look for a general price increase in the near future similar to the wave that swept up prices last fall and again in April.

United States Rubber furnishes the bulk of General Motors tires, Goodrich furnishes all of Chrysler and Hudson requirements. Goodrich has the largest share of General Motors' business outside of U. S. Rubber. Firestone has been furnishing more than half of all Ford tires.

Crude rubber prices have settled at a level of about 19c. and the industry does not expect any higher prices for the balance of the year. The retail price increase of January and March were predicated upon rising crude rubber costs. But in view of the fact that crude rubber now is back almost at the level of last October, crude rubber costs cannot be considered as figuring conspicuously in the advance in original equipment prices. The major factor governing the prices to car manufacturers now is higher labor costs.

## \$501 to \$750 Cars Gain

*Sales in That Class Higher; 3/4 Ton Trucks Move*

A further sharp increase in May United States and Canada factory sales of passenger cars in the price range \$501 to \$750, over both April, 1937, and May of last year is reported by the Automobile Manufacturers Association.

For the first five months of the year sales in the \$501 to \$750 class were 901,349 units against 704,297 units for the 1936 period. Sales in the \$751 to \$1,000 class were 63,841 units against 64,769. Sales in the \$401 to \$500 range were 353,933 against 434,720 last year.

A heavy gain in factory sales by United States and Canadian factories of 3/4 ton trucks was reported. For five months, the sales in this class were 7920 units against 2822 last year. Sales of 1 1/2 ton trucks, largest single class were 122,462 units for five months against 137,116 last year. Sales in the 2 1/2 ton group were 6087 units for five months against 1351 last year. Sales in the 5 tons and over group were 3288 units against 1884 for the like 1936 period. Special trucks and buses maintained small gains over last year.

## Tire Prices Are Raised

*Original Equipment Up 10 to 15 P.C. on July 1*

Original equipment tire prices to automobile manufacturers were increased between 10 and 15 per cent on July 1 by the four major tire companies supplying this primary market—Goodyear, Goodrich, Firestone and United States Rubber. Original equipment prices were last increased on Jan. 1 by about 5 per cent. A year ago prices were advanced about 5 per cent. There was no increase to car manufacturers on primary equipment when retail prices were advanced 6 per cent in January and also 6 per cent in March. The price increase will not be uniform, it was understood.



**VISIBILITY** test is applied by Chevrolet engineers to determine a driver's range of vision. The light is cast by a pair of lamps set in the same position as the driver's eyes and the

shadows are marked on the semi-circular wall. Lines of visibility are projected from the marks and figures obtained so the car designers may discover how much of the road can be seen.



# Machinery Unhurt by Strikers

*Damage to Non-essential Materials Was Considerable But Plants Were Able to Resume Production Quickly*

Damage at automobile plants caused by sitdown strikers appears to have been confined largely to non-essential materials with production machinery found unhurt after evacuation, a survey now shows.

The losses were not insignificant, however. An insurance adjuster has made a guess that the physical damage done to plants during all automobile plants strikes in Michigan would approximate \$200,000. This is apart from losses due to deterioration of materials left outside plants.

Evidence that production machinery was not wrecked by strikers is seen in the fact that the Plymouth plant was back to normal in less than two hours after the whistle blew on Monday, April 12, when the plants reopened after the strike which cost the company 24½ working days. Part of the rehabilitation work had been done before the plant reopened for production, of course. The agreement ending the strike was signed April 6.

Probably the worst case of sabotage was at the Fisher Body No. 1 plant at Flint during the January strike when it was reported that strikers had cut up expensive upholstering leather for weapons and had piled up body hardware for the same purpose. Outdoor work was exposed to the weather and body cloth was used for bed covers. These, it is said, may be considered necessary defensive measures on the part of strikers and not wanton destruction. The plants were littered with refuse and dirt in many instances, but there was little damage to machinery. There were, however, reports of malicious damage to filing cabinets and blueprints.

It is said that at one automobile

plant, the management was suspicious of emery dust on conveyor lines, and as a precaution drained out all the oil.

The psychology of the sitdown strike involved making it a peaceful demonstration. Strikers are said to have realized that anything they did to defer the resumption of operations after the settlement of the strikes would be as much to their disadvantage as to that of the company.

Considerable damage of a minor sort was done to plant exteriors by pickets who smashed windows and so forth.

There was also the factor of loss of completed and partly-completed cars. Hundreds of these, it is said, were pushed to plant walls and used as barricades, with the result that whenever strikers rushed to the walls they climbed over the cars and marred the bodies.

## Urges Fair Road Taxes

*Reeves, in Berlin, Outlines Sound Financing Basis*

Reasonable taxation of motor vehicle owners is justified because the motorist obtains a special benefit from road improvement, but the taxes should be conserved for the intended purpose, should be only a fair payment for the benefit received and should be related to ability to pay, Alfred Reeves, general manager of the Automobile Manufacturers Association, said in an address before the International Chamber of Commerce at Berlin, Germany, on June 29.

Mr. Reeves said that all benefit from roads, all should pay their cost in general taxes until motor transport develops to the point where special taxation can be used.

He remarked that it costs a nation less to borrow for road construction than to delay building until current revenues will finance the road improvements. Mr. Reeves recommended traffic surveys as a condition precedent to road building. He said that if the permanent factors are provided, including right of way, gradient for drainage and other engineering, the final surfacing can be delayed until traffic requires it.

Mr. Reeves commented that in the financing of a road building program, adequate maintenance provision is a prerequisite.

Financing of a road system can well be hastened by the issuance of bonds, but annual recurring costs should be met from taxes since there is less to be gained after the roads are built from borrowing the funds, said Mr. Reeves.

The speaker assailed road tax diversion, commenting that in 1936 there was a diversion of about 10 per cent or \$167,000,000 to purposes other than highway development. A basic cause for

this has been the need for unemployment relief funds during the depression. An effect in some places has been added road construction, but elsewhere road work has been retarded.

In his discussion of the present road development, Mr. Reeves cited the possibilities for long motor trips through newly opened territory, and said that these roads are but segments of projected highways. The major problem, he said, is the source of funds for further work.

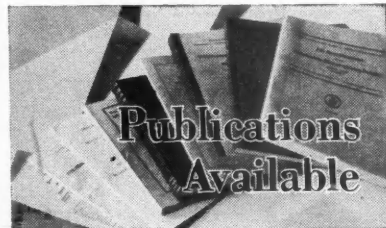
## Private Fleets Organize

A group of corporation fleet officials voted June 28 to organize the Private Carriers Division of the American Trucking Association, Inc. There had been some expectation that instead, a new national organization would be formed to represent the viewpoint of these carriers in regulative and legislative problems. The meeting was held in New York City and was attended by 24 representatives of major private fleets.

Value of the new division is expected to be its participation in the study of regulations and discussion of problems with the Interstate Commerce Commission and other regulatory bodies.

## Gasoline Tax Deductions

A fight waged by the Keystone Automobile Club since 1931 to give motorists of Pennsylvania the right to deduct gasoline tax payments from their income taxes finally has been won. An act of the recent Legislature, approved by Governor Earle, definitely places the gasoline tax on the "consumer," and beginning next year every motorist who pays an income tax may deduct his gas tax payments.



The Farre-Birmingham Co., Inc., has published a booklet on "The Futility of Federal Wage and Hour Regulations."

A booklet on "The Story of Plastic Molding" has been issued by the Chicago Moulded Products Corp. It includes articles on molds and materials.\*

A new edition of a manual "How to Run a Lathe" has been published by the South Bend Lathe Works. It was originally issued in 1907 and has been brought up to date many times since.\*

Roxalin Flexible Lacquer Co., Inc., has issued a product summary in leaflet form.\*

Copies of the Inland Steel Co.'s answer to the National Labor Relations Board's complaint are available.\*

Neveroil Bearing Co. has published a catalog, No. 10, covering oilless and self-lubricating bearings and special shapes.\*

Talks and presentations given at the 1937 regional conferences of the National Automotive Parts Association have been brought together in an illustrated book.\*

A bulletin illustrating Gisholt boring bars



International Photo

**SHIP-TO-SHORE** phone service in a new form will be available when Northwest Airlines completes installation of its plane-to-ground equipment, using the type of connection shown.

and reamers has been issued by the Gisholt Machine Co.\*

"How to Fly" is the title of an illustrated booklet published by TWA.\*

The Rockford Drilling Machine division of Borg-Warner Corp. has issued a booklet on its Pullmore clutches. It shows uses and gives construction details.\*

The Wrought Washer Mfg. Co. has published a special washer data chart. It contains complete size and dimension information.\*

A booklet discussing signalling systems for highway use is available. The title is "Moguls of the Rail and Highways in the U.S.A." It was published by the Beacon Corp. which also offers a large folder describing its products.\*

The Bristol Co. has issued a new 12 page bulletin on its recently developed round chart potentiometer pyrometers.\*

\*Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

## May Car Financing

*Was 8.6 P.C. under May, 1936  
but 4.7 P.C. Over April*

Dollar volume of new retail automobile financing for May was 8.6 per cent below that for May, 1936, but was 4.7 per cent above the figure for April, according to preliminary estimates by the Department of Commerce. Volume for the first five months of the year was about the same as for the like period in 1936 and showed a gain of approximately 55 per cent over the 1935 period. May financing was 61.4 per cent above that for May, 1935. It was 9.4 per cent below May, 1929.

The estimates were based on figures submitted by a sample group of companies which have been in continuous operation since 1929. The volume represented by the companies represents

about three fourths of the business written by all finance companies reporting, making possible estimates in advance of regular reports.

The largest April-May change since 1929 was a gain of 27.9 per cent in 1933. In 1936 it was a gain of 3.4 per cent, in 1935 it was a decline of 5.5 per cent and in 1934 it was a gain of 10.7 per cent. The 1929 gain was 9.2 per cent.

## Urges Governors in Canada

Suggestion was made by Chief George Smith of Winnipeg, Man., at a convention of the Chief Constables' Association of Canada held in Montreal, that authorities be requested to enact legislation forcing automobile manufacturers to install a "governor" which would not permit a car to travel faster than fifty miles an hour, and that the authorities be requested to pass by-laws preventing known criminals from obtaining automobile licenses. A third suggestion made by Chief Smith was that a law be passed prohibiting the use of short wave radios in automobiles unless by a permit from the chief of police.

## Sales to Puerto Rico Gain

Sales of automobiles and trucks to Puerto Rico will set a new high record during the current fiscal year. Shipments to the island during the first ten months of the fiscal period show an increase of 38 per cent as compared with the same months of last year, according to the Puerto Rican Trade Council.

"Purchases by the island from manufacturers in continental United States in the ten months ending with April, 1937, were 3638 units compared with 2439 units in the same period last year," the report states. "For the ten months, shipments of passenger cars are 35 per cent higher, with truck sales 44 per cent above last year. As usual, about 85 per cent of the passenger cars fall in the low-priced group."

## New Engine For Latest Diamond T

*Six-Cylinder Hercules, With Features of Heavy-Duty Line  
Powers 1-1½ Ton Truck Model Just Announced*

A six-cylinder engine of new design powers the 1-1½ ton truck, model 301, just announced by Diamond T. Built by Hercules Motors Corp., the features characteristic of the larger heavy-duty engines are retained and construction includes seven bearing crankshaft, large side mounted water pump, full depth cooling, gear driven front end and pressure lubrication to mains and rods. Bore and stroke are 3⅞ in. by 4⅞ in., and actual output is 66 hp. at 3000 r.p.m.; N.A.C.C. rating, 27.34 hp.

Cadmium nickel alloy bearings are used in mains and rods, and all journals of the 2½-in. crankshaft are surface hardened by the Tocco process. Engine mounting is four point rubber suspension with torque arm developed by Diamond T to isolate engine vibration from the frame. A linkage arrangement allows clutch and brake pedals and master cylinder to be rigidly attached to the frame.

Model 301 is equipped with Lockheed internal expanding brakes on all four wheels. Brake drums are 14 in. in diameter and 2 in. in width, except when 20 in. wheels are furnished, in which case rear drums are 15¼ in. by 2¼ in. Braking pressure is automatically equalized on all four wheels and take-up for lining wear is accomplished by cam adjustment. The hand brake is in a contracting band mounted at the rear of the transmission.

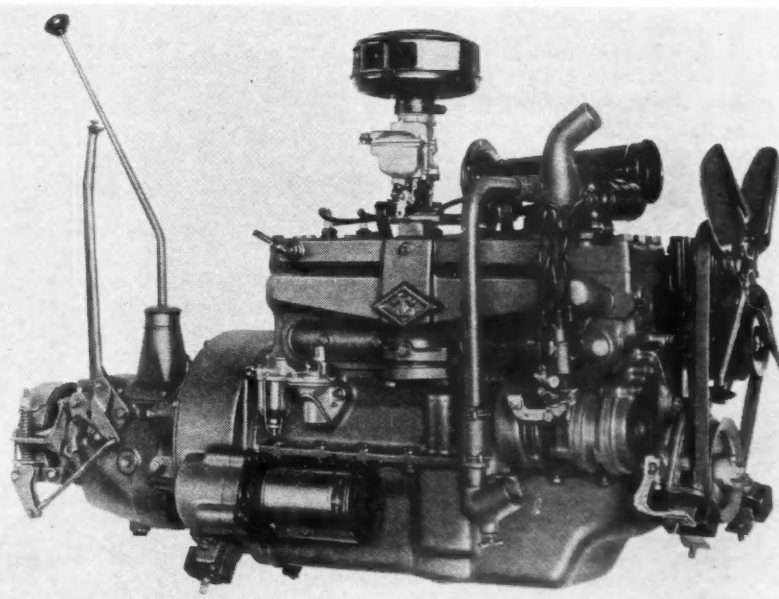
The rear axle is full floating spiral bevel with double Timken wheel bearings directly above the tires. Ratios are 4.62 for standard 16 in. single tires, 5.14 for 16 in. dual tires and 20 in. single tires, 5.43 for 20 in. dual tires.

The two-piece propeller shaft has three needle bearing universal joints and the intermediate bearing is a double

thrust Timken roller, cushion-mounted in rubber to provide flexibility. The 10-in. clutch is provided with a self-lubricated throw-out bearing.

Houdaille hydraulic shock absorbers are standard equipment in front, and front springs (38 in. long and 2 in. wide) were designed to work with them as a unit. Rear springs are under-slung and only the upper section is used when the truck is empty. The four lower leaves add capacity for loads. Frame and spring design allow

(Turn to page 32, please)



**NEW ENGINE** developed by Hercules Motors Corp. for the recently announced model 301 Diamond T 1-1½ ton truck. Features include: seven main bearings, force-feed lubrication, light weight four-ring pistons,

cadmium nickel alloy bearings in mains and rods, crankshaft journals surface hardened by Tocco process, and a new recirculating type thermostat which combines with water-pump to give automatic temperature control.



## Business in Brief

Written by the Guaranty Trust Co., New York

### Business Rate Holds

There were no signs of a slackening in general business activity last week, despite the continuation of strikes. Retail trade was estimated from 2 to 5 per cent above that in the preceding week and from 12 to 22 per cent above that in the corresponding period last year. Conditions were generally favorable for agriculture, although cultivation was retarded by too much rain in some sections between the Western Lake region and the Ohio Valley. The Southern States received well-distributed rainfall.

The Guaranty Trust Company's index of business activity for May stood at the preliminary figure of 95.1, as compared with 95.5 the month before and 82.2 a year ago. The company's index of wholesale commodity prices on June 15 was 84.8, as compared with 87.0 a month earlier and 67.3 a year earlier.

### Carloadings Rise

Railway freight loadings during the week ended June 19 totaled 756,289 cars, which marks an increase of 1929 cars above those in the preceding week, a gain of 65,822 cars above those a year ago, and a rise of 189,240 cars above those two years ago.

Production of electricity by the elec-

tric light and power industry in the United States during the week ended June 19 was 11.3 per cent above that in the corresponding period last year.

Lumber production during the week ended June 12 stood at 82 per cent of the 1929 weekly average and was slightly below the levels in the last three weeks in May. New business was the lowest for any week this year, while shipments were above those in the preceding week and were almost equal to those in the highest weeks of the quarter.

Average daily crude oil production for the week ended June 19 amounted to 3,510,950 barrels, as compared with 3,515,900 barrels for the preceding week and 2,963,400 barrels for a year ago.

### Fisher Index Steady

Professor Fisher's index of wholesale commodity prices for the week ended June 26 stood at 92.0, as compared with 91.9 the week before and 92.0 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended June 23 showed declines of \$1,000,000 each in holdings of discounted bills and of bills bought in the open market. Holdings of Government securities remained unchanged. Money in circulation declined \$21,000,000, and the monetary gold stock increased \$50,000,000.

## Activity Grows in Japan

### Engine Rebuilding Company Among Units Formed

The piston ring unit of the Riken (Physical and Chemical Research Institute), the Otaki Natural Gas Co., the Fukoku Industry and the Keisei Tramcar Co. have jointly formed a company for the reconstruction of automobile engines and parts to be imported from the United States. It will also import semi-finished Ford and Chevrolet engines for which it will grind cylinders and fit pistons. The company will be known as Riken Jidosha Kaizo K. K. (Riken Rebuilt Automobile Co., Ltd.).

The Ikegai Iron Works, machine tool

maker, has founded a separate automotive unit under the name of Ikegai Automobile Mfg. Co. It will take over the Iron Works' Kawasaki plant and will continue the latter's Diesel line. The Ikegai Foundry Works, Kawaguchi, is supplying castings for the Diesels.

Negotiations are under way for the formation of a firm, to be jointly controlled by Japanese promoters and a German aircraft engine manufacturing company, to make aircraft engines, carburetors and accessories. Identified with the Japanese end of the project is Capt. T. Hattori, Imperial Navy, retired.

The Tokyo Gas and Electric Industry Co., maker of "Kamikaze" aircraft engines, will place that division on a joint stock basis.

Two new spark plugs have appeared in the Japanese market. One is the N.G.K. porcelain plug for aircraft engines up to 800 hp. and is produced by the Nippon Tokushu Tokyo K.K. (Nippon Special Pottery Co., Ltd.), an affiliate of Nippon Gaisha Kaisha, Nagoya. The other is the P.M.P. mica plug for automobile engines, product of the Kyodo Electric Machinery Co., Kamata, near Tokyo.

British-designed "Amal" carburetors will be produced under license in Japan by Mikuni Shoten, Kamata. Capacity will be 20,000 a year.

### Packard Electric Expands

The first Packard automobile, a large portion of the industry's requirements of ignition cable, magnificent engineering laboratories for Lehigh University; these, before 1932 were the principal products of the Packard Electric Co. which now, as a General Motors divi-

sion, has enlarged its floor space to 300,000 sq. ft. with additions completed in August, 1936, and in May of this year.

J. W. and W. D. Packard gave their name to the automobile in 1898 and to the ignition cable in 1903. Their early expansions gave his first automotive business to Albert Kahn, celebrated architect. Acquired by General Motors in 1932, the plant has tripled its employment in the past five years and is producing cable at the rate of about 2,000,000 ft. daily. B. N. MacGregor heads the division for GM.

## Books

of automotive interest

"Leichtmetallkolben" (Light-Alloy Pistons) by Richard Krüger. Published by Richard Carl Schmidt & Co., Berlin W 62, Germany.

This book deals with the subject of light-alloy pistons in a rather comprehensive way, covering the historical, the technical (metallurgy, design, production) and the service phases.

One chapter of the book under review is devoted to piston materials, the two types dealt with principally being copper-aluminum and silicon-aluminum alloys. Then follow two chapters on solid-skirt pistons (the second on special designs), one on split-skirt pistons, one on pistons with steel or invar inserts, and one on bimetallic pistons. All of these chapters go at considerable length into the design of pistons of the particular type dealt with, and they are all well illustrated. The remaining chapters cover protective coatings for pistons (such as that produced by the anodizing process), production, and assembly and operation. The book, which contains 140 pages of standard size and 140 illustrations, forms an interesting monograph on this branch of automobile engineering which has passed through several phases of development during the last two decades.

### ... slants

THAT'S A LOT—More than 1,500,000 motorists called on the American Automobile Association for assistance when they ran out of gasoline on the road last year. This is a surprisingly large number in view of the fact that there are about 200,000 filling stations in the country, not counting such garages as may also sell gasoline. There are 3,000,000 miles of highways in the United States.

NEW USE FOR TANKS—Suggestion that amphibian tanks, somewhat like the newer Army apparatus, be used for polar flight airbases has been made by Professor Otto J. Schmidt, leader of the Soviet North Pole Expedition. The tanks would provide means for establishing emergency air landing fields and



COL. A. C. DOWNEY has been appointed president of Airtemp, Inc., Chrysler subsidiary engaged in the manufacture of air conditioning equipment, and R. L. BIGGERS has been named president of the Fargo Motor Co. fleet sales unit, it was announced by K. T. Keller, Chrysler Corp. president.

P. M. HELDT, engineering editor of AUTOMOTIVE INDUSTRIES, sailed Thursday, July 1 for a visit to Europe. He will return early in September. In the meantime, Mr. Heldt can be reached in care of Frau Johannes Westensee, Burg auf Fehmarn, Germany.

H. O. WARD, director of advertising and sales promotion of the export division of the Chrysler Corporation, was elected president of the Foreign Trade Club of Detroit at the annual meeting. W. C. NEVERMAN, export manager, McCord Radiator Company, was elected a director.

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Automotive Industries



additional fuel supplies for the planes. The tanks would be serviced by special fuel planes from the mainland.

**GOOD HOUSEKEEPING**—Open house for families and guests of workers in Plants No. 1 and No. 3 of the Campbell, Wyant & Cannon Foundry Co. at Muskegon, Mich., with prizes given for the cleanest departments, was a method chosen recently by the company for obtaining the interest and cooperation of the families of employes in matters relating to safety and hygiene. The departments were also arranged to show the materials and production methods used, with appearance of the displays a factor in the prize awards.

**ROAD RACE RECORDS** — Two Graham cars have recently set new road race records in widely separated parts of the globe. One, a "116" supercharged model covered 950 mi. of rough roads between Cape Town and Johannesburg, South Africa, in 17 hr. 15 min. The other, a "120" supercharged car, won the "Circuito Apoquindo" for closed cars at Santiago, Chile. Watched by 50,000, it covered the twisting course over city streets and roads with an official 98.732 k.p.h. (61.4 m.p.h.).

### Plant Notes

Addition of nearly 60,000 sq. ft. of floor space to the Pontiac Motor plant, in preparation for greater volume in the near future, was announced by H. J. Klingler, general manager. Three separate new buildings, all either already under construction or soon to be started, comprise the expansion program. One is a new structure to house a school for plant apprentices; another a new foundry addition to be used mainly for core storage, and the third a separate plant administration building which will also house executive dining and conference rooms.

City Auto Stamping Co., Toledo, has awarded a contract for a \$100,000 addition to its stamping plant to provide it with adequate storage space at the plant. Recently the company has leased some space a considerable distance away. The 140 sq. ft. addition is to be completed about Aug. 1.

Haynes Stellite Co., Kokomo, Ind., has announced plans for the construction of a new building at its plant in Kokomo to provide room for the company's growing business. Plans call for a new two-story fireproof office building, 132 ft. long and 44 ft. wide. This new structure is the first of several contemplated under an expansion program. Plans also provide for remodeling the present office building into a recreation center.

### George C. Ussher

George C. Ussher, 55, general credit manager of the Studebaker Corporation, died June 25 in his room in the Fort Dearborn hotel, Chicago, from a heart attack.

## Automotive Metal Markets

### Second Half Operations Outlook Held of More Importance Than Price Structure Except in Non-Ferrous Divisions

Significant of the metal market's frame of mind at the year's half-way mark is that what has taken place in the last six months is completely ignored in appraising the outlook over the remainder of the year. Compared with the year's opening prices, finished steel has advanced from \$5 to \$7 a ton. As the result of the strike epidemic, operating rates monopolize the attention of the market and the price structure is receiving less consideration than it has in a long time.

Somewhat more interest in this phase is in evidence in the market for non-ferrous metals, however. During the first half of 1937, electrolytic copper advanced 2 cents a pound or 16 2/3 per cent over the year's opening figure of 12 cents. For the time being, due to intermittent outbreaks of war scares in Europe, the export price is looked upon as the index to the situation. After a reassuring dip, the quotation for electrolytic copper in Liverpool, Havre and Hamburg was again marked up on Monday to parity with our domestic price.

Straits tin is selling today at about 6 cents a pound over the year's opening price level, a rise of approximately 12 per cent. At a luncheon-meeting of the American Tin Trade Association within the week, J. van den Broek of the Billiton Company, one of the world's largest producers, and a member of the International Tin Committee, expressed himself as decidedly displeased with the severe "oscillations" of tin prices, stating that they were just as much of a hardship to producers as to consumers. He was not at all enthusiastic about the efficacy of production quotas as a remedy, although he thought them of some help. He pointed out that the owners of tin mines did not sell to producers, but to smelters, who, in order to protect themselves, had to resort frequently to hedging transactions. The International Tin Committee's aim was to give the consumer a fair deal but if commodity prices in general moved higher, tin could not help being affected, he said. A Bolivian producer predicted a considerable increase in the tin output of that South American republic in the near future. Zinc prices have risen approximately 11/3 cents or 23 per cent in the first half of 1937. Lead sold this week at the same price as it did during the first week of the year.

**Pig Iron**—Shipments in June are reported to have held up remarkably well, having exceeded expectations in some districts. The market is firm and unchanged.

**Aluminum**—The sole domestic producer of primary aluminum announced a few days ago that a plant for the manufacture of aluminum tubing and extruded shapes would be erected near Lafayette, Ind., and would go into production before the end of the year. The undertone of the market for secondary aluminum is easier.

**Copper**—Amid rather light demand, producers' price for electrolytic holds steady at 14 cents. The "outside" market is quoted at 13 1/2 to 14 cents.

**Tin**—After opening the week at 56 1/2 cents, 3/4 cents below the preceding week's close, spot Straits tin eased off fractionally on Tuesday when 56 1/2 to 56 1/4 cents was quoted.

### General Body Output Begins

First passenger trailer marking the beginning of production in the plant of the General Body Corporation came off the assembly line this week. H. Jay Hayes is president of the company.

The new trailer, which will be manufactured in three sizes, is to be marketed under the trade name of "Stream-Lite" reflecting the marked streamlining of the all-welded steel coach and its light weight in proportion to size. The first unit is 17 feet long. It is completely decorated, furnished and equipped for the road. Wide use of insulation is a feature.

### Motor Fire Apparatus

Shipments of motor fire apparatus for May were 72 units against 74 in April, and 48 in May, 1936. For the first five months of the year shipments were 339 units against 233 in the 1936 period. Sixty-three pumping engines and 9 other motor fire apparatus were shipped in May, against 63 and 11 in April. In May, 1936 the totals were 41 and 7.

### Dealer Salvage Yards Few

The National Automobile Dealers Association reports that out of 144 dealer associations answering a questionnaire, four own salvage yards, one has an interest in a yard and several have owned yards in the past. Several of the reporting associations are considering the establishment of yards.

## 40 Years Ago

with the ancestors of  
AUTOMOTIVE INDUSTRIES

### "Motor Vehicles in Warfare"

... Roads which in time of peace are good soon become neglected and demoralized in time of war, and a vehicle, like a soldier, should be able to accommodate itself to all inconveniences. Tires of rubber, whether pneumatic or solid, are inadmissible, both because of the greater weight to be carried and because of the rough usage to be endured. Iron tires alone meet the requirements, and, in view of the greater torsional strains, the hubs should be larger than would otherwise need to be, while, in order to clear surface obstacles, the diameter of the wheels should not be less than that now found in field artillery.

Electricity is barred as a motive power, on account of the impracticability of charging accumulators in the field or en route, and steam or petroleum motors alone remain; between these steam having the preference, at last for greater powers, since petroleum motors at present are not satisfactory above ten horse power. Practically a motor vehicle for military service must be a carefully designed steam traction engine, planned to haul artillery and supply trains anywhere where horses can go; the questions of speed and personal comfort, so important in pleasure vehicles, need hardly be considered.

From *The Horseless Age*, July, 1897.

### Carbohydrate Carburants

The third International Congress on Carbohydrate Carburants will be held in Rome from Sept 10 to 12, it was announced by the committee in charge. At the meeting will be discussed technical and economic problems concerning their use. It is expected that delegates from all parts of the world will attend.

The Congress was organized by the Consiglio Nazionale delle Ricerche (National Research Council) with the collaboration of the Reale Automobile Club of Italy and the Italian Touring Club. President of the organization committee is Prof. Nicola Parravano of the Italian Academy.

### Automotive Freight Large

Rail shipments of automobiles, parts, tires and materials together with road building materials, produced freight revenues of \$450,732,000 in 1936, according to data disclosed by J. S. Marvin at a meeting of traffic managers, members of the Automobile Manufacturers Association.

This figure is based on a study of the final Commodity Reports of the Interstate Commerce Commission. The items listed by the Association as automotive freight are: 1,171,000 carloads of gasoline for automotive use; 726,154 carloads of motor vehicles, parts and tires; 336,400 carloads of cement for roads and bridges; 563,800 carloads of gravel, sand and stone for roadbuilding; 256,000 carloads of iron and steel

## AUTOMOTIVE INDUSTRIES

*Looking Ahead*

1938's AUTOMOBILES are advanced in this issue, so far as general changes are concerned. When the time comes for the preparation of actual descriptions of the new cars, we are planning some changes ourselves which we hope will add to the value of the descriptions as they are printed. For executives—the sales points of the new cars will be highlighted in an entirely separate story instead of being lumped in with the engineering descriptions. For engineers—there will be "straight" technical descriptions with more of the engineering drawings which have caused so much favorable discussion in our issues since last November.

REMEMBER, when you were young, how many margins of schoolbooks you "decorated" with your idea of how an automobile should look? Kids still do it and their drawings now reflect a good many changes in design and perhaps foreshadow some of the future. We don't expect it to prove anything, but we've collected a lot of these modern children's drawings of automobiles, and plan to print them in an early issue.

for the factories, and 542,020 carloads of oil, lumber and other supplies, making a total of 3,595,374 carloads.

Automotive freight was 30.3 per cent of the revenue carloads classified by the commission as "manufactures and miscellaneous" and was 13.8 per cent of all revenue carload freight handled.

### Sunday Closing Popular

The National Automobile Dealers Association reports that of 164 cities surveyed, dealer establishments are closed in 81 on Sundays, open in 75, and closed half a day in 6. In 61 cities the closing is effected by dealer agreement, in 8 by state law, in 14 by city ordinance and in 4 by union demands. In 28 cities Sunday closing has been tried and failed, due in almost all cases to one or two dealers who feared the loss of some business. A majority of dealers seem to favor Sunday closings.

### NSPA Index Shows Gains

May automotive sales index of the National Standard Parts Association went to 159, 2 per cent above the April figure of 156, and 15 per cent over the May figure a year ago which was 138. All index figures are related to the average monthly sales for 1934 as 100. Average monthly sales have been up 12 per cent for five months.

Replacement parts shipped to wholesalers were indexed at 127, a decline of 5 per cent from April's 134, but unchanged from a year ago. Average monthly sales have been up 8 per cent.

Service equipment and tools shipped to wholesalers dropped as an index from 166 to 160, or 4 per cent, but set up a gain of 14 per cent over May last year which was 140. Sales for five months were up 4 per cent.

Original equipment shipped to vehicle manufacturers stood at 315 and was 2 per cent over April's 310.

## Calendar of Coming Events

### SHOWS

- Second Winter Item Show, Automobile Accessories Association, Chicago, Aug. 9
- Poland, Automobile Salon (Foire Orientale), Lwow .....Sept. 1-15
- Yugoslavia, Automobile Section, Autumn Fair, Ljubljana .....Sept. 1-12
- Yugoslavia, Automobile Section, Commercial Fair, Belgrade.....Sept. 11-21
- France, 31st International Automobile Salon, Paris .....Oct. 7-17
- Great Britain, 31st International Automobile Exposition, London....Oct. 14-23
- Czechoslovakian Automobile Show, Prague .....Oct. 16-24
- National Automobile Show, New York, Oct. 27-Nov. 3
- Toledo, O., Automobile Show...Oct. 27-Nov. 3
- Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
- Boston, Mass., Automobile Show, Oct. 30-Nov. 6
- Los Angeles, Cal., Automobile Show, Oct. 30-Nov. 7
- San Francisco, Automobile Show, Oct. 30-Nov. 7
- Cincinnati Automobile Show.Oct. 31-Nov. 6
- Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London...Oct. 14-13
- Chicago Automobile Show.....Nov. 6-13
- Akron Automobile Show.....Nov. 6-12
- Omaha Automobile Show.....Nov. 6-11
- Brooklyn Automobile Show.....Nov. 6-13
- Columbus Automobile Show.....Nov. 6-12
- Detroit Automobile Show.....Nov. 6-13
- Motor Truck Show, 4th Annual, Newark, N. J. ....Nov. 6-12
- Newark, N. J., Truck Show.....Nov. 6-12
- Buffalo, N. Y., Automobile Show..Nov. 6-13

### Show Business

Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

- Indianapolis, Automobile Show....Nov. 6-13
- Newark, N. J., Automobile Show...Nov. 6-13
- Philadelphia Automobile Show....Nov. 6-13
- Pittsburgh, Pa., Automobile Show.Nov. 6-13
- Toronto, Ont., Automobile Show...Nov. 6-13
- Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20
- Baltimore, Md., Automobile Show, Nov. 13-20
- Cleveland, Ohio, Automobile Show, Nov. 13-20
- Jersey City, N. J., Automobile Show, Nov. 15-20
- Milwaukee, Wis., Automobile Show, Nov. 17-24
- Springfield, Mass., Automobile Show, Nov. 14-20
- St. Louis, Mo., Automobile Show.Nov. 14-21
- Portland, Ore., Automobile Show.Nov. 14-21
- Denver, Colo., Automobile Show, Nov. 15-20
- Montreal, Que., Automobile Show, Nov. 20-27
- Kansas City, Mo., Automobile Show, Nov. 27-Dec. 4

### CONTESTS

- Roosevelt Raceway, 300-Mile George Vanderbilt Cup Sweepstakes (Rain date July 5) .....July 3
- 31st Annual Grand Prix of the Automobile Club of France, Linas-Monthéry .....July 4
- National and International Soap Box Derby Finals, Akron, Ohio.....Aug. 15
- Pan American Cup Race, Roosevelt Raceway .....Sept. 6
- National Outboard Championship Regatta, Richmond, Va.....Sept. 18-19

### CONVENTIONS AND MEETINGS

- U.A.W. Annual Convention, Milwaukee, Aug. 23
- S.A.E. Section Regional Tractor Meeting, Akron, Ohio.....Sept. 15-17
- American Transit Association, 56th Annual Convention, White Sulphur Springs, W. Va.....Sept. 19-23
- S.A.E. Section Regional Transportation Meeting, Chicago .....Sept. 29-Oct. 1
- American Foundrymen's Association Midyear Meeting, Columbus, Ohio, Sept. 30-Oct. 1
- S.A.E. Fuels and Lubricants Regional Meeting, Tulsa, Okla. ...Sept. 30-Oct. 1
- S.A.E. National Aircraft Production Meeting, Los Angeles, Calif.....Oct. 7-9
- American Foundrymen's Association, Regional Conference, Rolla, Mo., Oct. 8-9
- S.A.E. Annual Dinner, Commodore Hotel, New York.....Oct. 28
- American Petroleum Institute, 18th Annual Meeting, Stevens Hotel, Chicago .....Nov. 8-12
- S.A.E. National Production Meeting, Flint, Mich. ....Dec. 8-10

July 3, 1937

Automotive Industries

# Just Among Ourselves

## The GM Strike Teaches—

AT the end of June the Bureau of Labor Statistics reported that strikes during February in the automobile industry cost 465,000 man-days of lost labor. Thus, four months later, the labor situation begins to be seen in figured perspective. General Motors reported last week that its millionth car produced this year was only a week behind the millionth produced last year. But this statement ignores the "normal expectancy" of a 10 to 15 per cent growth in this year's production. The intimation from the General Motors statement would be that the corporation was retarded only a week by strikes in its production program to date. Our guess would be, including the growth expectancy, that four to six weeks would be the amount of retardation. Speculation on what might have been is not particularly practical but if it can help to drive home the lesson that strikes cost everybody money, so much the better.

\* \* \*

## Will Retailers Get Their Way?

L. W. MOFFETT, who heads our Washington staff, reasons soundly that the Federal Government is particularly interested in preserving retailers' interests against the consumer. For this rea-

son, he thinks, Washington (meaning Congress) will not investigate automobile factory-dealer relationships.

Such investigation, you will remember, is sought in two resolutions introduced in Congress by Representatives Gardner Withrow and Harry Sauthoff, both of Wisconsin.

From farther off, we're wondering what effect the Federal Trade Commission's citation of General Motors for forcing dealers to take extra accessories will have on the matter.

It may be only a lovely coincidence that official "evidence" of the things Representatives Withrow and Sauthoff are talking about should appear on the scene when an investigation is being asked for. Or maybe it isn't.

\* \* \*

## A Sop Might Be Expedient

PRESIDENT LIED of the National Automobile Dealers' Association has endorsed by letter, Mr. Withrow's resolution, and Mr. Withrow got a chance to air his views on the floor of the House on June 15. Retailers as a group have not fared too well under past and pending legislation. We're a little afraid that it may be found convenient to throw a sop to automobile dealers, in the interest of solidifying the Administration's position with retail trade interests as a whole.

## Who Wants 'Em?

MANY of our engineer-readers have found it profitable to maintain complete files of the engine drawings which have been appearing each week since last November. The demand for extra sets has been larger than we can fill from normal stock. Before providing reprints we should like to know how many readers would be interested in completing their sets of the drawings or obtaining complete extra sets. May we have a word from those who would. You are not obligated in any way by letting us know.

\* \* \*

## "Tempus Fugit" As Records Grow

STUDEBAKER, now in its eighty-sixth year as an institution, maintains and justifies pride in its age and traditions. But Gläfers, a firm of automobile body builders in Dresden, Germany, and the firm of Peugeot in France have age records which make Studebaker's look rather youthful.

The first Gläser product was sedan chairs, and they began making them well back into the eighteenth century. The first Jean Pierre Peugeot got his start long before Cugnot invented his steam carriage by associating the tool-making artisans of Montbéliard. The firm he founded has been continuously under control of the same family for more than 150 years.

Peugeot produced a steam tricycle for the Paris Exposition of 1889, and was making a gasoline quadricycle in 1891. The company is now the second largest automobile manufacturer in France and employs about 25,000 workers on automobiles alone.—H. H.





Fig. 1—Complete inspection of the finished main crankcase of the double-row engine. Note the number of gages in front of the inspector. Each case receives 100 per cent inspection in which various types of gages shown in the illustration are used. Limits on flush pin gages average plus or minus 0.002 in. tolerance. Main liner holes are inspected with flat type go-and-no-go plug gages to a tolerance of 0.0005 in. All tapped holes are given 100 per cent inspection in accordance with Class 3 National Fine Threads Standards. Note: three separate sections and an assembled section appear in the picture, showing how the sections are built together in the engine.

BY H. E. BLANK, JR.

**P**RIME factor in production of aircraft engines at the Pratt & Whitney Aircraft plant in East Hartford, Conn., is the precision that marks manufacture of all component engine parts. Extremely close tolerances, high finish, and many rigorous inspections enter into the making of every unit which is assembled into a Wasp or Hornet air-cooled, radial type power plant. Due to the especially exacting requirements essential to successful manufacture of aircraft engines, the production methods differ in many respects from those which are current practice in automobile factories. At Pratt & Whitney Aircraft the first variation instantly apparent is the layout of the main shop.

All manufacturing facilities are housed in a modern one-floor structure 1000 ft. long and 400 ft. wide. There are no conveyors, several elements peculiar to aircraft engine production

precluding use of such equipment. The fine finish given to many parts, a large number of which are made of soft alloys, dictates the need for unusual precautions in handling completed units to prevent damage. Rate of production in itself does not necessitate high-speed movement of materials. Furthermore, the general scheme of production utilizes straight-line methods only for manufacture of separate parts or related groups of parts.

In accordance with the general plan of operations, the entire floor layout is divided into departments tooled for machining individual units to completion. To provide maximum flexibility, virtually all machinery is direct motor driven. Variations in engine design re-

quiring major change in sequence of operations could be readily accommodated and the arrangement of equipment also allows for convenient expansion to meet increased production demands. Should it be necessary to add to present capacity, department production lines could be extended laterally beyond the walls of the factory. The building is designed to make such change a relatively simple matter.

A wide, middle aisle extends the full 1000 ft. length of the main factory building and provides ample passageway for men and electric trucks used to transport materials. So far as it is feasible, engine parts made of non-ferrous metals are machined on one side of the aisle and parts made of ferrous metals

# PRECISION

*is the watchword in the Pratt & Whitney aircraft engine plant. Exacting requirements prompt a technique unique in production methods*

## THIS IS THE SIXTEENTH IN THE SERIES OF MONTHLY PRODUCTION FEATURES

on the other. A number of main parts are made of light metals: cylinder heads are aluminum sand castings; crankcases are dural forgings; pistons are dural forgings; blower sections are cast of aluminum or magnesium—those of magnesium being supplied by the American Magnesium Corp.; and rear sections are cast of aluminum or magnesium.

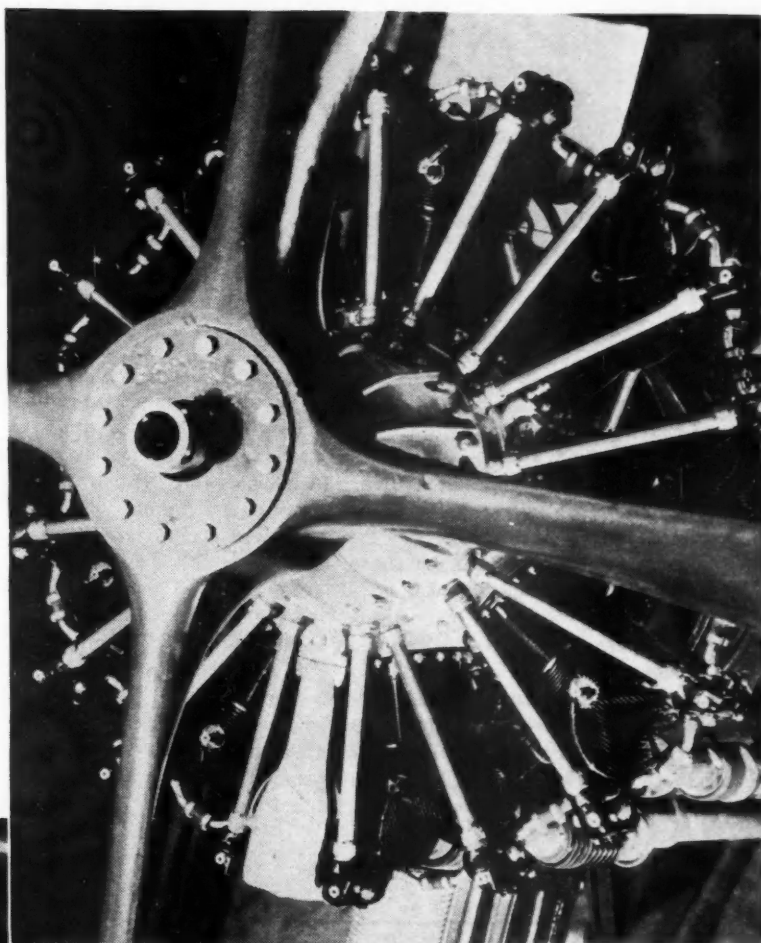
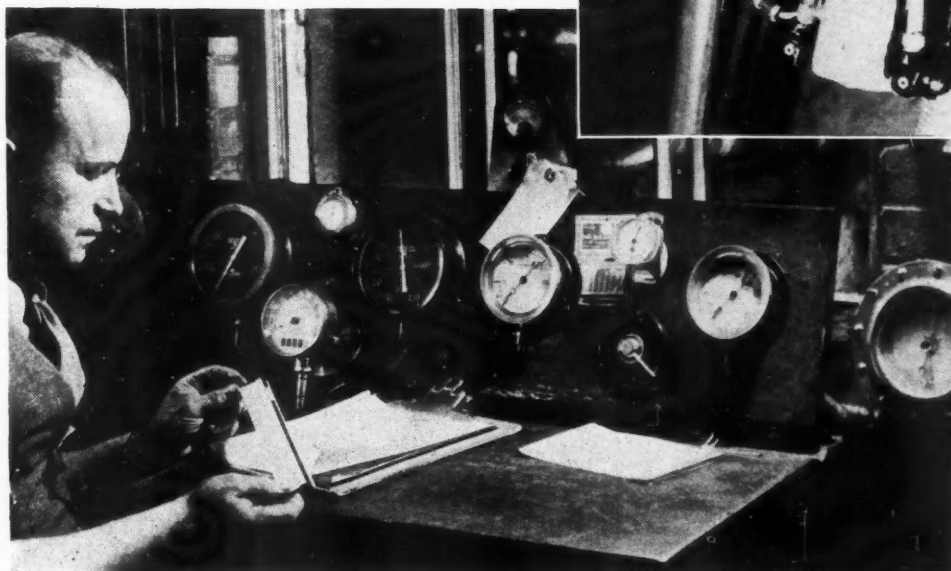
Raw materials and finished parts are purchased to meet only the requirements of current production schedules. That is, each group of materials obtained from a vendor is intended for use in engines which are on order. As the metallurgical character of raw materials vary, each lot is machined to completion wherever possible. Naturally, this cannot always be done. For instance, some order contracts call for production of 200 engines of a certain design over a period of five months. Other orders are being pushed through

the plant at the same time. Hence, only sufficient number of parts is machined to provide for smooth flow of production to meet order requirements. However, as many parts as possible are machined before retooling, and overs are sent to finished stores.

Soon after material arrives at the plant it is placed in production. Exact-

ing specifications are issued to the vendor of materials with every order and constant vigilance of inspection maintains the quality of all material at high standards. Before shipping any material, vendors check conformity of the material with order specifications. For example, among other rigid tests made on cylinder head castings before shipment to the plant, the Aluminum Co. of America subjects one out of every hundred castings to X-ray examination.

**Fig. 2 (Below)**—Operator's instrument panel in the production engine test control chamber. The following instruments are visible: left to right, manifold pressure manometer tube, oil outlet temperature gage, tachometer with r.p.m. counter, stop watch, carburetor air temperature gage, oil pressure gage, pyromillivolt meter, dual ignition switch (left, right, or both), watch, and fuel pressure gage. Not shown are: fuel weigh tank, oil weigh tank, vacuum gage for indicating negative pressure below the carburetor, torque indicator scale, oil inlet temperature gage, wet and dry bulb thermometer, mercurial barometer. Note the double panel safety glass observation window.



**Fig. 3 (Above)** — Torque stand for production engine test. This is a view of 3:2 reduction gear H-1 Wasp engine with wooden 4-bladed test propeller. Note the carburetor inlet scoop in the center foreground. There are 24 of these test stands at Pratt & Whitney.

## Executive Personnel

### Pratt & Whitney Aircraft Co.

General Manager....C. W. Deeds  
 Asst. Gen. Mgr.....J. C. Ward, Jr.  
 Engineering Mgr....L. S. Hobbs  
 Factory Mgr. ....B. H. Gilpin  
 Sales Mgr. ....T. E. Tillinghast  
 General Supt. ....J. J. Borrup  
 Mach. Shop Supt....D. Jack  
 Assembly & Test  
 Supt. ....W. Willgoos  
 Production Engr. ...C. J. Marks

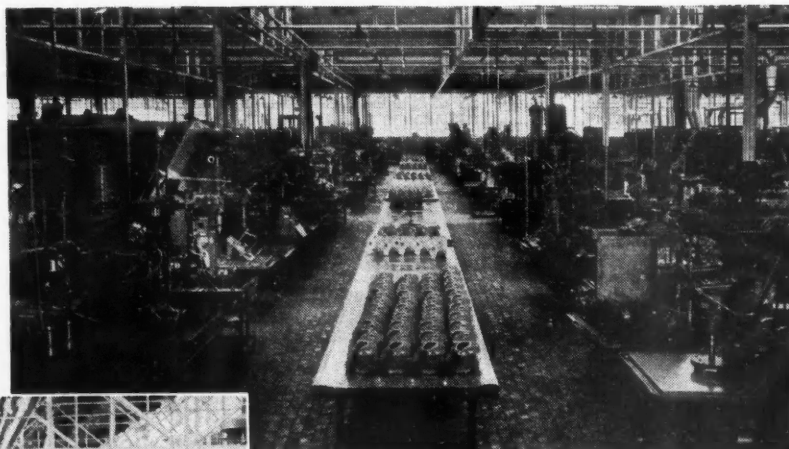


Fig. 4 (Above) Department for machining aluminum cylinder-head castings. Approximately 50 different types of cylinder heads are manufactured on this line. The arrangement is typical of the equipment layout for machining other parts, the straight-line production scheme being used only for manufacture of separate units, and related groups of units.

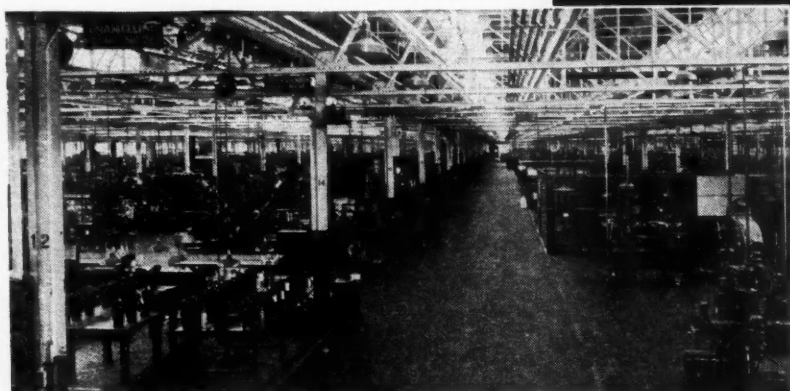


Fig. 5 (Left) Interior view of the Pratt & Whitney Aircraft engine factory. The wide middle aisle provides passage the full length of the building for movement of men and materials. Parts made of non-ferrous alloys are machined to the left of the central aisle, those of ferrous alloys to the right. Note that all equipment is individually motor-driven.

Technical representatives of Pratt & Whitney cooperate with the suppliers of materials in the maintenance of specification criteria.

Materials supplied by outside sources are inspected again when received at the engine factory. Army and Navy inspectors make separate check on those materials assigned to engines on government order. Preliminary inspections are very important because it is unquestionably sound economics to detect flaws before costly labor is expended. As previously intimated, inspection plays a leading role in the attainment of quality production in this plant. There are in the organization approximately 170

inspectors, 40 of whom are women.

Details of machining operations on the cylinder head castings, all of which are supplied by the Aluminum Co. of America, and cylinder barrels provide excellent example of the production practices at Pratt & Whitney. A photograph on this page. Fig 4 shows the cylinder head production line, typical of the straight-line arrangement followed out in all other unit manufacturing departments in the plant. Before being machined, the cylinder heads are given 100 per cent visual inspection. A sprue is cast on the head for the purpose of locating the head in the first turning operation. This sprue is faced

and drilled and the cooling fins are turned down for chucking diameter on the operation to follow.

Heads are next chucked up on an automatic turret head lathe and the machining done on this equipment includes rough and finish bore of the dome, turning the inside thread diameter, facing the flange, and turning the outside diameter of the flange. Here is a typical instance of close tolerance. The flange outside diameter must be machined to within 0.0005 in. as the dimension is used for locating the cylinder head in subsequent operations. For this operation the cylinder head is centered on the hole drilled in the sprue for the purpose and clamped on the outside diameter of the cooling fins.

A fixed center type of fixture is used for the operations of boring, facing, reaming, and tapping of cylinder head port holes. It is shown set-up on a drilling machine in Fig. 11. Work is located for center distance from the outside of the lower flange of the head which is held within plus or minus 0.0005 in. Plugs are placed in the valve guide holes and fitted into a central slot in the back of the fixture to provide for positive angular location of the work.

## Current Production Commercial Aircraft Engines

Engine	A.T.C. Power Allowable for Take-off		Crusing Power Rating		Best Power Critical Alt. (ft.)	A.T.C. Normal Rating		Fuel Alt. (ft.)	Oct. No.	Bare Wgt. Lbs.	Engine Diameter (in.)
	hp.	r.p.m.	hp.	r.p.m.		hp.	r.p.m.				
Wasp Jr. ....	450	2300	300	2000	9,600	400	2200	5000	87	610	45 $\frac{3}{8}$
Wasp ....	600	2250	400	2000	11,800	550	2200	8000	87	883	51 $\frac{1}{8}$
Hornet ....	800	2300	525	2000	12,800	750	2250	7000	87	1015	54 $\frac{7}{8}$
Hornet ....	800	2300	525	2000	10,800	750	2250	4000	87	1015	54 $\frac{7}{8}$
Twin Wasp Jr. ...	750	2500	485	2200	14,000	700	2500	8500	87	1070	44 $\frac{1}{8}$
Twin Wasp ....	1000	2600	625	2150	12,800	900	2450	6500	87	1235	48

\*Bare weight includes carburetor, magnetos, oil pump, spark plugs, plain ignition wiring, one tachometer drive and generator drive.



A swinging type of fixture is also used with offset adjustment for various cylinder heads having angularly faced ports.

Subsequent operations include drilling, reaming, and facing valve guide holes, facing intake and exhaust ports, drilling rocker shaft holes, machining spark plug holes, turning down cooling fins, removing the sprue, and drilling a number of small holes.

Threads are milled in the cylinder head in one operation. After this the head is burred, washed, and thoroughly cleaned in a Detrex degreaser. (In general, solvent degreasing is used to remove oil and grease from metal parts preparatory to heat-treating, electroplating, bonderizing, enameling, inspection, and slushing with rust-preventative oil. Heat treat and plating departments use Blakeslee degreasing machines.) All cylinder heads are then given complete inspection; tapped holes being tried with a go-and-no-go gage.

Directly across the aisle from the cylinder head department, cylinder barrels are machined. The rough cylinder barrel forgings are first brinelled. If they

### Within Twelve Years . . . .

**T**WELVE years ago F. B. Rentschler and G. J. Mead organized the Pratt & Whitney Aircraft Co. and began building an experimental 400 hp. radial aircraft engine in the plant of the Pratt & Whitney Machine Tool Co., Hartford, Conn. The small cubicle in which they worked was previously part of the Pope-Hartford automobile factory. Within five months, these men and their associates, including Donald L. Brown, A. V. D. Willgoos and J. J. Borrup, produced the first Wasp engine. Close to a million dollars was expended in the developmental work which led, in 1926, to a government order for 200 Wasp aircraft engines.

Since that time Pratt & Whitney engines have become world famous through their use by air line operators and military services. In addition to the single-

row Wasp and Hornet types, Pratt & Whitney has pioneered in development of the first successful American twin-row engines, which are now finding wide favor in higher-powered military and commercial airplanes.

In 1929, the United Aircraft & Transport Corp., of which the present United Aircraft Corp. was a part, was formed and the present layout, with nearly a half-million square feet of floor space, constructed in Hartford. The present organization spreads over 585 acres, includes the Pratt & Whitney Aircraft factory, administration and engineering buildings, the Hamilton Standard Propellers plant, Chance Vought Aircraft factory, hangar for experimental planes, an overhaul station, and a modern airport.

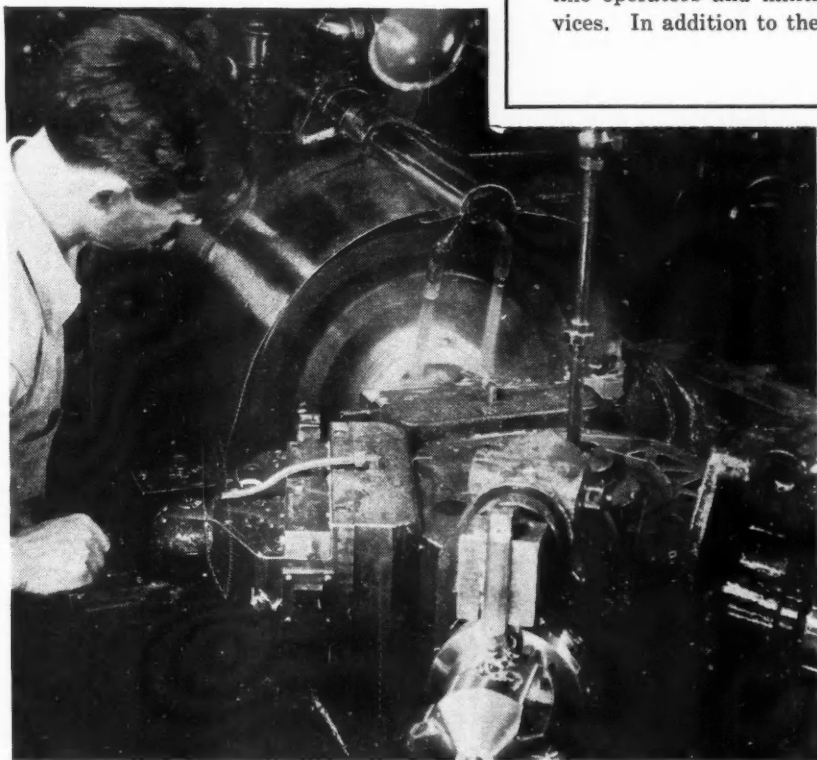


Fig. 6.—Operations performed on this Potter & Johnson machine include rough and finish bore of the cylinder head dome, turning the inside thread diameter, facing the flange, and turning the O.D. of the flange. The flange O.D. is machined to within 0.0005 in. as the flange is used for accurately locating the cylinder head in subsequent machining operations. The machine is fully automatic except that it must be loaded and unloaded by the operator. For this series of operations, the head is clamped on the O.D. of the fins and centralized on a dowel hole which is added to the casting for the purpose.

meet specifications they are chucked up in a lathe and the outside diameter is rough turned, then the flange.

While much of the equipment throughout the plant is standard, there are many instances of adaptation of special devices and tooling to the standard machines. An interesting example of this is the special tooling adapted to an automatic lathe for cutting cooling fins on cylinder barrels. There are three types of tools used; sides of the fins are turned down by separate tools, a third cuts out the center radius. Fins machined to size are only 0.02 in. thick.

An unusually large amount of material is removed in machining forgings from the rough state to finished dimensions. For instance, the weight of the cylinder barrel forging after rough turning is 33 lb.; when completely machined, 7.8 lb. The piston in the rough forged state weighs 7.95 lb. and is machined down to 4.45 lb. An even more impressive example is the amount of material removed in machining the master rod for the single row engine. The master rod rough forging has an original weight of 58.72 lb. and a machined weight of 15.02 lb., a difference

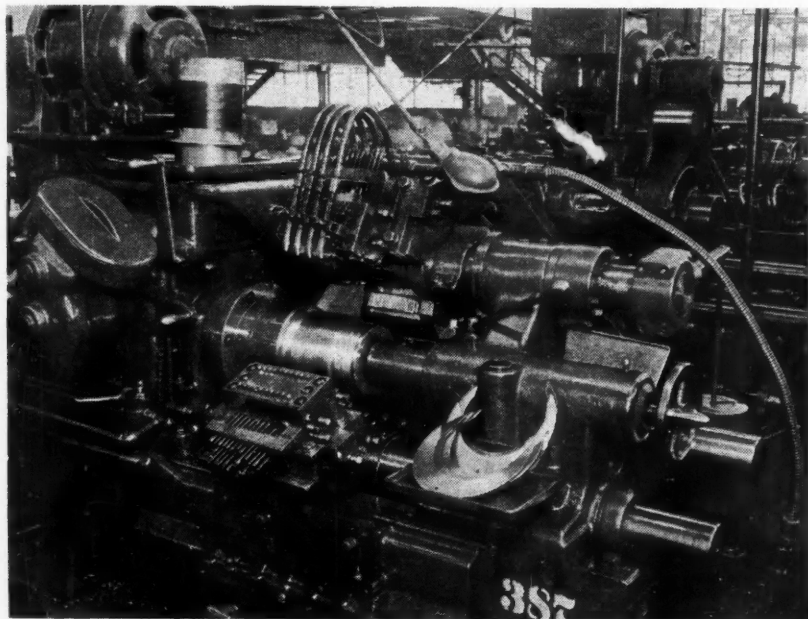


Fig. 7.—Fay automatic lathe with special equipment for cutting tooling fins on cylinder barrels. In this operation fins are grooved out of the solid steel barrel and are 0.020 in. thick when completed. Three sets of tools are used, one each for cutting sides of the fins and a third for turning out center portion between fins.

of 43.70 lb. Original forgings are made husky due to the absolute necessity of having uniform grain section in the finished piece.

Cylinder barrels are chucked for threading operation by an expansion chuck which acts on the bore and holds the work concentric. Milling of the threads is accomplished by a series of tools that rotate and move forward according to pitch. The mating thread is

hobbed on the cylinder heads on similar machines of an internal type.

In grinding the barrel, the tolerance is plus or minus 0.001 in. and specifications call for a finished surface straight and round within 0.0005 in. A 60-I Norton wheel is being used in grinding the chrome-moly steel barrel, with a No. 141 grinding solution supplied by the International Chemical Co. Completed cylinder barrels are bonderized and

moved across the aisle for assembly to the cylinder head; the only instance where parts cross the middle aisle which divides the ferrous and non-ferrous machining operations.

Prior to shrinking heads on the cylinder barrel the aluminum heads are placed in an electric oven and heated up to 550 deg. Fahr. In addition to assembling the head to the barrel a number of fittings are installed in the cylinder head, such as the steel exhaust valve seat, aluminum-bronze inlet valve seat, and steel cylinder sleeves which are screwed and shrunk into place. This is all done at one heat.

When the cylinder head is shrunk on to the barrel, which has been previously ground, the resulting effect is termed a "choked" barrel. Actually, the barrel is pushed in at the point where it joins the cylinder head to approximately 0.015 in. to 0.020 in. choke on the diameter. The principal advantage is obtained under engine operating conditions when the head expands, due to high temperatures, more than the bottom of the barrel. Advantage is taken of the

## Summary of Operations on Master Rod

Type of Machine	Description of Operation	Oper. No.	Type of Machine	Description of Operation	Oper. No.
Milwaukee vertical miller	Rough mill sides	1	Kearney & Trecker vertical miller	End mill 18 deg. 35 min. angle to blend with 1½ in. radius (both sides)	17
	Rough forging inspection	2	Barnes drill press	Drill and ream 0.680 in. radius both sides	18
Pratt & Whitney surface grinder	Surface grind sides	3	Kearney & Trecker vertical miller	Rough circular mill between flanges	19
Sundstrand miller	Straddle mill wrist pin end	4	Milwaukee vertical miller	Rough circular end mill 3 19/64 in. radius	20
Barnes drill press	Drill- re-drill and ream wrist pin hole	5	Milwaukee vertical miller	Finish circular end mill 3 19/64 in. radius	21
Barnes drill press	Rough and finish bore main bearing hole	6	Milwaukee plain miller	Straddle mill cap seats	22
Milwaukee plain miller	Mill cap seats	7	Milwaukee plain miller	Straddle mill cap seat chamfers	23
Barnes drill press	Bore 1½ and 1 in. radii	8	Milwaukee vertical miller	Circular mill hub contour, both sides	24
Barnes drill press	Rough and finish 1½ in. radius	9	Milwaukee vertical miller	Rough mill wrist pin end	25
Barnes drill press	Rough drill and counter-bore in "T" section	10	Milwaukee vertical miller	Finish mill wrist pin end	26
Kearney & Trecker vertical miller	Mill top of web at 2 deg. 33 min. 46 sec. (both sides)	11	Milwaukee vertical miller	Mill off surplus stock from wrist pin end, both sides	27
Kearney & Trecker vertical miller	Mill both sides to blend with 1½ and 1 in. radii	12	Barnes drill press	Form 1/32 in. radius on top of wrist pin boss	28
Milwaukee vertical miller	Rough mill "T" section, both sides	13	Avey drill press	Drill (1) No. 19 (0.166 in.)	29
Milwaukee vertical miller	Finish mill "T" section, both sides	14	Avey drill press	Drill (2) 5/16 in. holes (wrist pin end)	30
Barnes drill press	Spot and drill knuckle pin holes, drill and ream lightening hole	15	Behrlich electric oven	Bake at 550 to 600 deg. Fahr. for ½ hr.	31
Barnes drill press	Counterbore knuckle pin holes both sides	16			

## Operation Sheet on Master Rod

Type of Machine—Barnes Drill Press

Operation No. 10

### Description of Operation

Name of Tool

Clean locating surfaces, lower support pin, place rod in fixture and clamp large end lightly  
Locate with stud in wrist pin hole and clamp tight against big stud

Base plate  
Counterboring fixture

Bring support pin up to hub and tighten

Clamp large end tight with "C" washer and nut

Rough drill 25/32 in. radius into "I" section to 1 1/8 in. dia. and to 3/32 in. high from center of rod to point of drill and holding 4 5/32 in. center dimension

1 1/8 in. dia. drill  
1 1/8 in. dia. drill holder

Counterbore 25/32 in. radius to 1.552 in., +0.000 to -0.010 in. dia. and to 1/16 in., +0.005 to -0.000 in. high from center of rod holding 3/16 in. radius and 4 5/32 in. center distance

1.552 in. dia. counterbore  
1.562 in. dia. counterbore holder

Rough drill 1/2 in. radius to 15/16 in. dia. and to 3/32 in. high from center of rod to point of drill holding 1 25/64 in. center to center dimension

15/16 in. dia. drill and holder

Counterbore 1/2 in. radius to 0.990 in., +0.000 to -0.010 in. dia. and to 1/16 in., +0.005 in. to -0.000 in. high from center of rod holding 3/16 in. radius and 1 25/64 in. center to dimension

0.990 in. dia. counterbore and holder

Turn rod upside down and repeat above operations

Note: Thickness of "I" section must be 1/8 in., +0.010 in. to -0.000 in. to allow for polishing, all cuts must be smooth

1.552 in.—1.542 in. plug gage  
0.990 in.—0.980 in. plug gage

2-in. micrometer with extension for 1/8 in., +0.010 in. to -0.000 thickness.

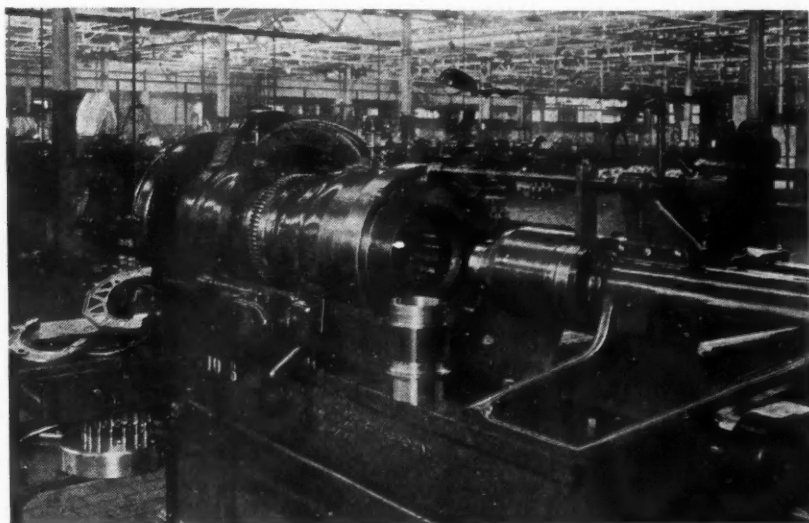


Fig. 8.—Hall planetary machine for threading cylinder barrels. The work is held concentric by an expansion chuck in the bore. Threads are milled by a series of tools that rotate and move forward according to pitch. At completion of the cycle, the machine automatically reverses. Similar machines of an internal type hob the mating thread in the cylinder head.

"choking" effect and it is said that oil consumption is materially reduced thereby.

It was interesting to note that 16 hold-down stud holes are now being drilled into the cylinder barrel. This number used to be 12; a definite indication of increased engine power.

After the cylinder head is shrunk on to the barrel and other fittings are inserted, the assembly is taken to the lacquer pit. Assembled units intended for Navy aircraft engines are given a zinc-chromate primer which inhibits rust of the steel barrel and prevents corrosion of the aluminum head. All units are sprayed with Japan black lacquer and subjected to a 4-hr. bake at 400 deg. Fahr. Prior to the spraying operation, all holes in the cylinder head-barrel assembly are carefully plugged to prevent paint entering the inside. It

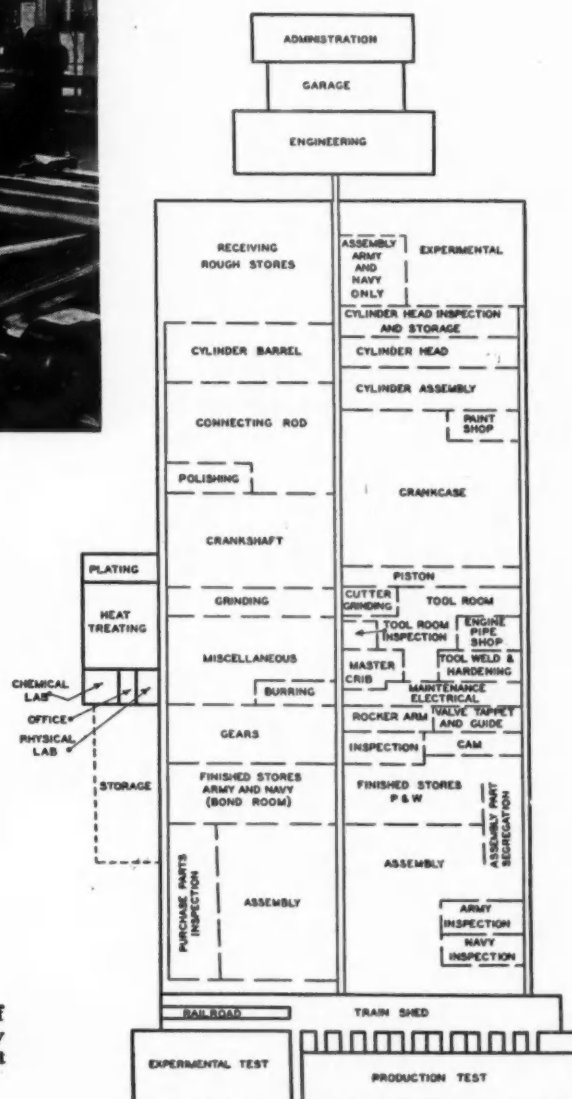


Fig. 9. Floor plan of the Pratt & Whitney aircraft engine plant



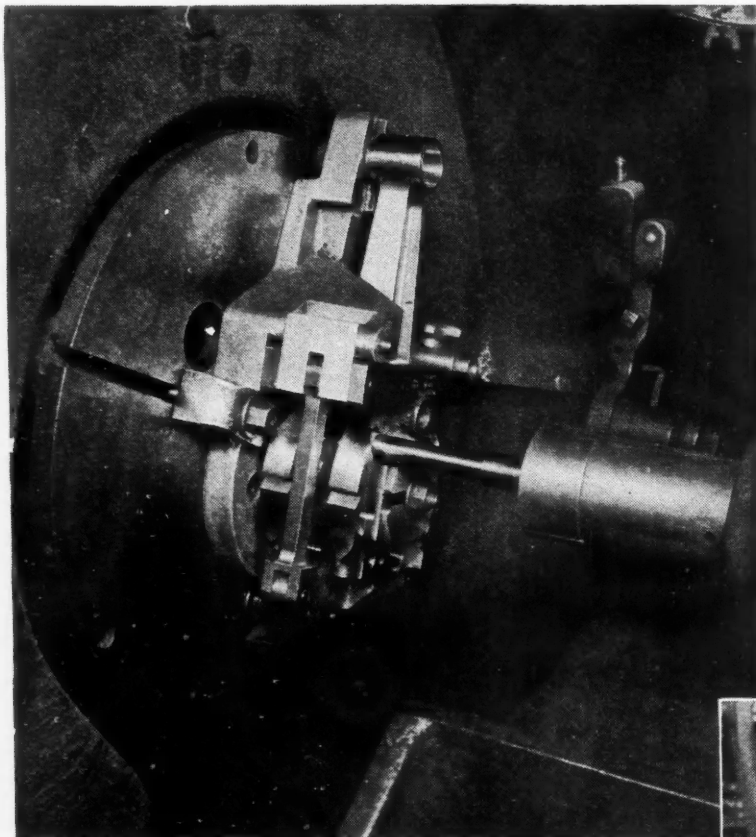


Fig. 10—Bryant hole grinder set-up for finish-grinding articulated rod-pin holes in a double-row master rod. To prevent distortion of the rod, the entire fixture that holds the cap on the rod floats on four pins. Holes are spotted in the fixture to correspond with holes to be ground in the master rod. The fixture is made of aluminum alloy to minimize effect of centrifugal forces.

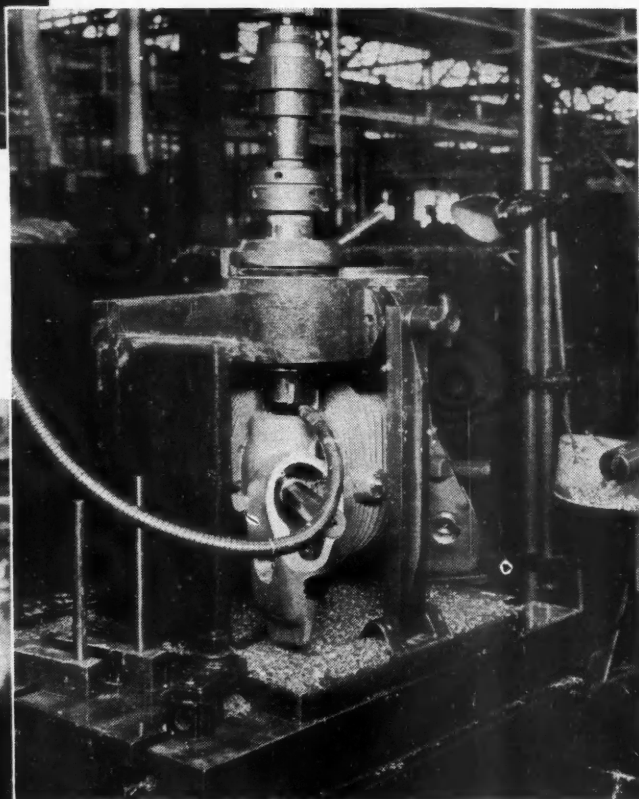


Fig. 11—(Above) Carlton Radial drilling machine rigged with a fixed center type of fixture. Operations performed with the set-up are: boring, facing, reaming and tapping of cylinder port holes. Location of work for center distance is from the outside of the lower flange which is held within plus or minus 0.0005 in. for the purpose. Plugs placed in valve guide holes and fitted into a central slot in the back of the fixture provide positive angular location. Work is held rigidly against the back of the fixture by the substantial hinged strap shown in the front. For the tapping operation a lead screw is provided on the tool bar.

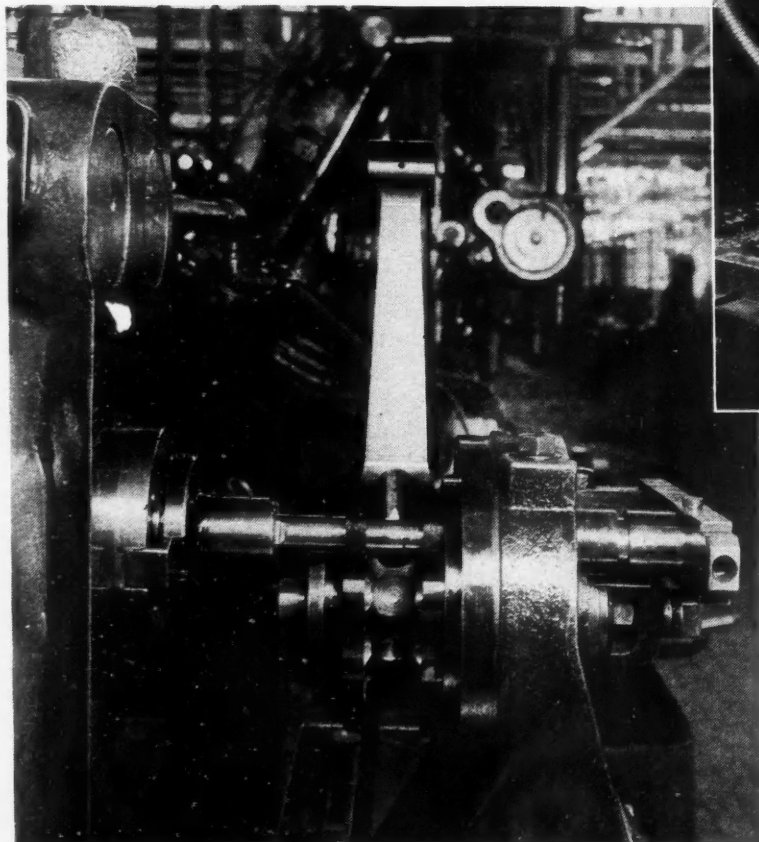


Fig. 12—(Left) Master rod set-up on Milwaukee equipment for machining between flanges to provide clearance for the head of the articulated rod. Note the effect just below the arbor of a previous operation countersinking the formed counterbore with a drill press. The flycutter shown here is being used as a roughing tool. After the roughing operation, a formed flycutter is passed through, then reversed, in order to blend in flanges with the clearance groove. The outer arbor bushing fits into reamed holes in the master rod.

with the aluminum head. Assembled units are again inspected by Pratt & Whitney and Navy or Army inspectors, depending whether the unit is intended for commercial or government use, then sent to the finished stores department.

Details on sequence of operations for machining a master rod from the rough to the finished state are given on pages 14 and 15. These details were obtained from sheets summarizing operations which are supplied to the manufacturing department foremen. Additional routine data are printed on the sheets, including the part number, kind of material, and department number. Machine operators are supplied with similar sheets listing in detail the sequence of operations, dimensions, and tolerances for which they are individually responsible.

Some examples of precision tolerances required are: piston ring grooves held to 0.0002 in. of being square; wrist pin bosses diamond bored to tolerance limits of plus 0.00035 in. to minus 0.00025 in. diameter; and piston pin outside diameter lapped within plus or minus 0.00025 in.

No evidence of the close weight tolerances maintained in production of parts at Pratt & Whitney appears on the operation sequences reproduced here. The double-row master rod assembly, for example, is held to a specified weight tolerance of 0.03 lb. It is interesting to note that if the component parts which make up this particular assembly were finished to maximum tolerance limits, the entire assembly would be overweight. The link rod when polished to final finish must check to a weight tolerance of 0.01 lb. Pistons are

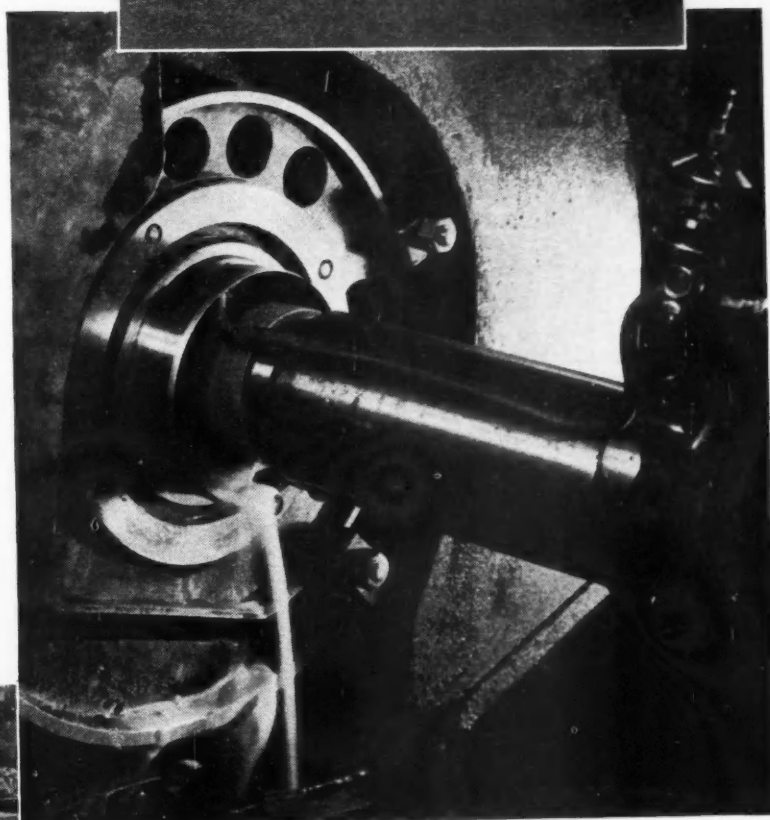
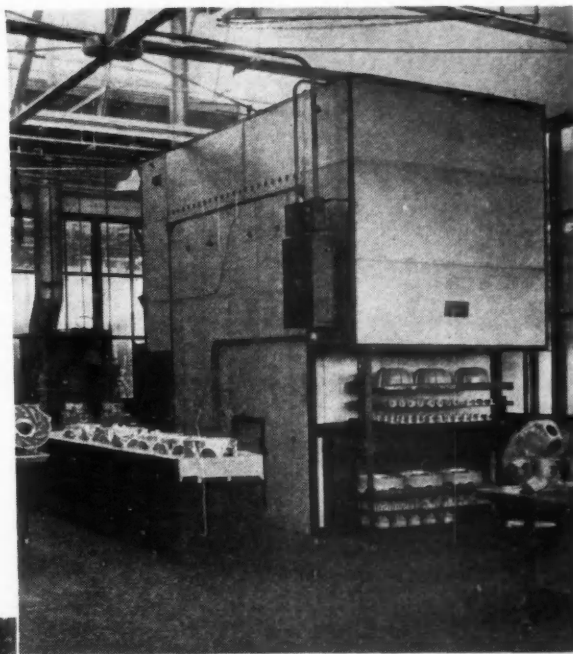
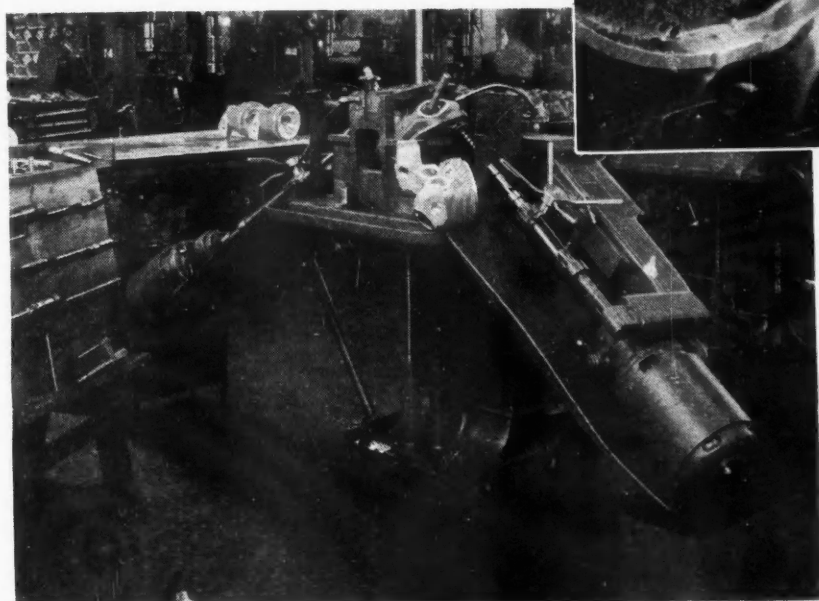


Fig. 14—(Top) Gehrich conveyor-type, electric oven for drying various primers and paints.

Fig. 15—(Center) Grinding the cylinder barrel with a Bryant deep hole grinder prior to shrinking on the head. A 60-l Norton wheel is being used in grinding the chrome-moly alloy steel barrel, with No. 141 grinding solution supplied by the International Chemical Co. Grinding tolerance is plus or minus 0.001 in., and the finished surface must be straight and round within 0.0005 in.

Fig. 16—(Left) Leland-Gifford 2-spindle machine for drilling rocker shaft holes in the cylinder head. A special machine of which several different types are required to manufacture the various active cylinder designs.



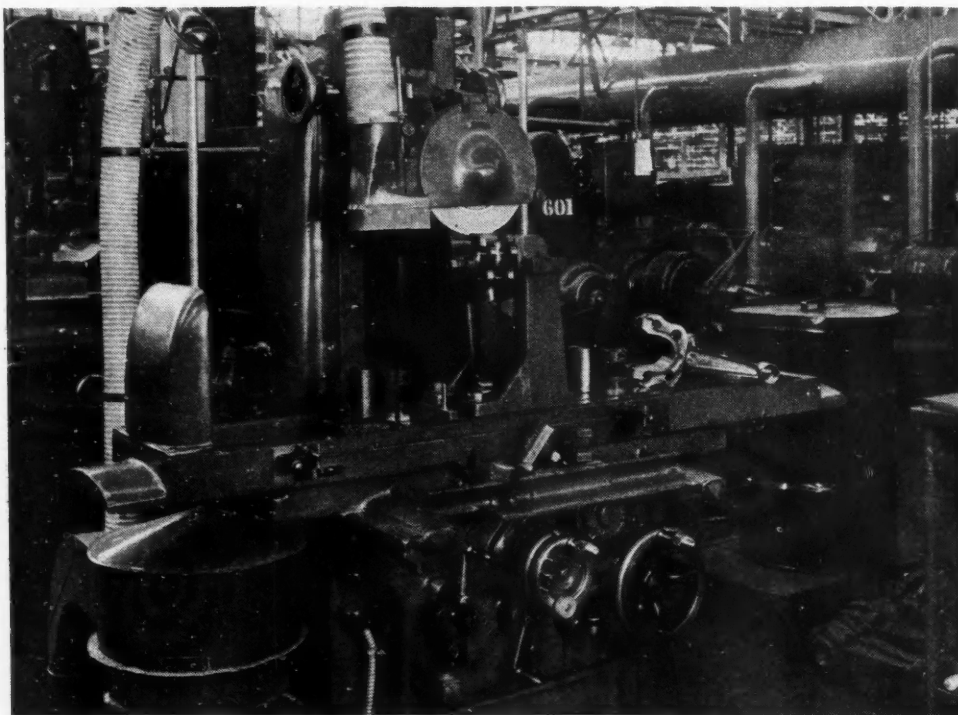


Fig. 17—Master rod shown set up on Abrasive machine for operation which grinds the parting surface to mating fit with cap. Ground caps are used as a gage to test mating surface on the rod and no tolerance is allowed on final finish surfaces of either part. The clamping fixture holds the rod against a half plug made in the form of a crank-pin.

held to a plus or minus 0.01 lb. weight limit. The master-rod single row within 0.02 lb.

Reasons for giving parts high finish are several. Designers of aircraft engines have constantly before them the problem of reducing weight to horsepower ratio. Parts must be designed to withstand maximum conditions of stress and must be absolutely reliable under all operating conditions. Furthermore, parts must be interchangeable. Any small tool scratches permitted to remain

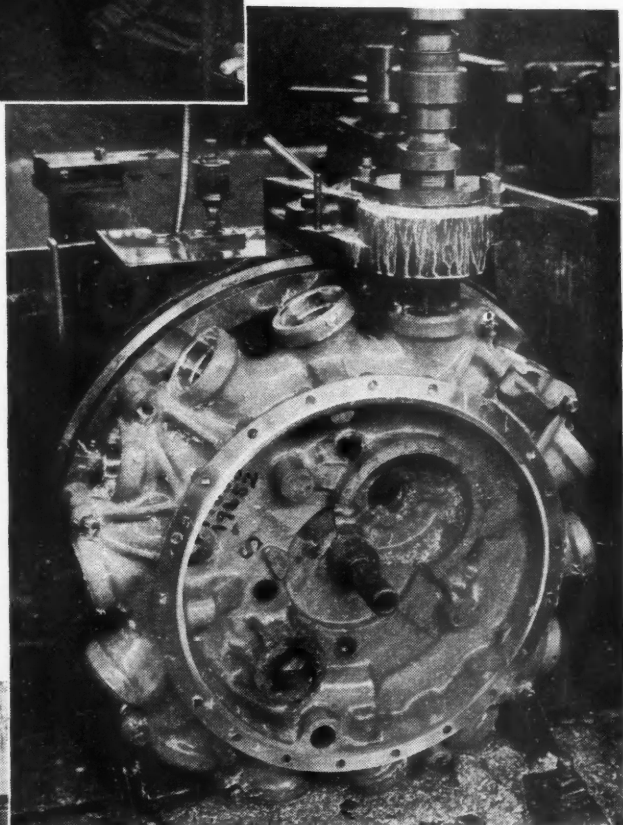


Fig. 18—(Above) Fixture for boring and tapping operations on blower section port holes. In this fixture, mounted on a Morris radial drill, the casting is located by a central plug and a dowel which registers in one of the eight engine mounting bolt holes. The casting is held rigidly against the face of the fixture by screws in the remaining seven bolt holes. The operation illustrated is tapping and it will be noted that, for this operation, a lead screw is provided on the tool bar.

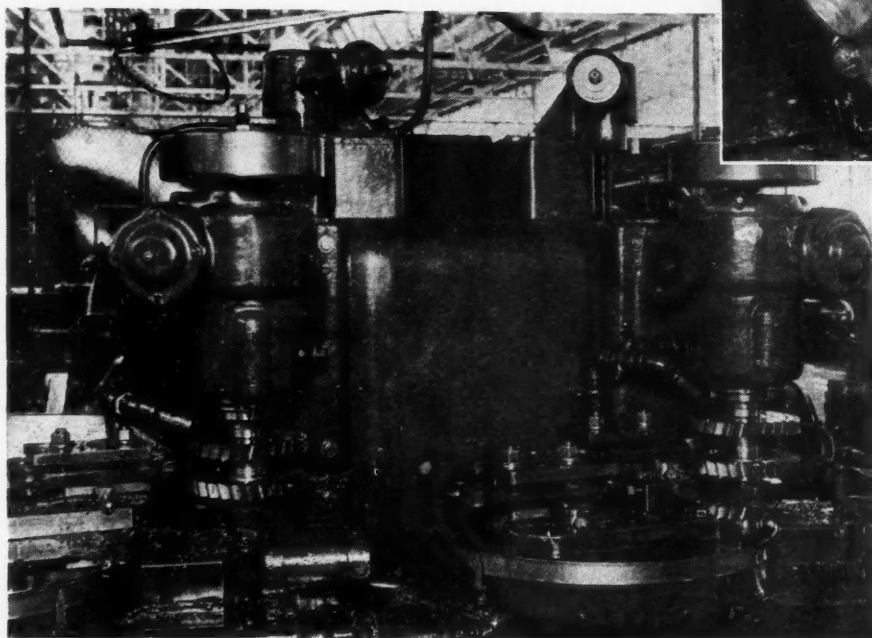


Fig. 19—(Left) Sundstrand machine arranged for milling operation on ends of link rods. Work pieces are clamped on rotary tables and the operation is continuous. Cutters on the left spindle mill both faces on one end of the articulated rod and the operator changes rods to the table at the right for facing the other end which is of different thickness. Various types of rods can be quickly accommodated on this machine by a simple changeover of the turntable clamping fixtures.



on the surface of a highly stressed part might easily be the starting point for failure. This accounts in part for the painstaking care with which aircraft engine parts are polished and it is interesting to see men in this very modern Pratt & Whitney production plant, doing laboriously slow handwork on various pieces to achieve the desired high finish. As part of inspection routine, many engine parts are magnafluxed and a high surface finish naturally shows up minute defects better with this type of inspection.

A number of special fixtures have been designed by Pratt & Whitney engineers for unusual machining operations where standard machinery is used. Several outstanding examples are illustrated in the photographs reproduced herewith. Fig. 10 shows in detail the fixture used to clamp the double-row master rod while articulated rod-pin holes are finish ground. The unit is made of aluminum alloy to minimize the effect of centrifugal forces. So that the rod will not be distorted, the entire fixture is designed to float on four pins. Other types of fixtures include a device

for clamping the master rod during grinding of the cap mating surface, Fig. 17; jig for holding blower section during boring and tapping of port holes, Fig. 18; fixture for holding crankcase section during milling operation, Fig. 20; and arrangement for holding the crankcase for the operation of drilling the tappet guide holes, Fig. 21.

Completed parts and group assemblies are transported on electric trucks

to the finished stores department. They first go to a dispatching floor located in the storeroom. Units are classified according to the purpose for which they are intended, most of them to be assembled into commercial, Army or Navy engines, and a few for spare parts stock. All parts to be assembled into engines are segregated one month prior to the scheduled assembly date. This allows ample time for making up any  
(Turn to page 37, please)

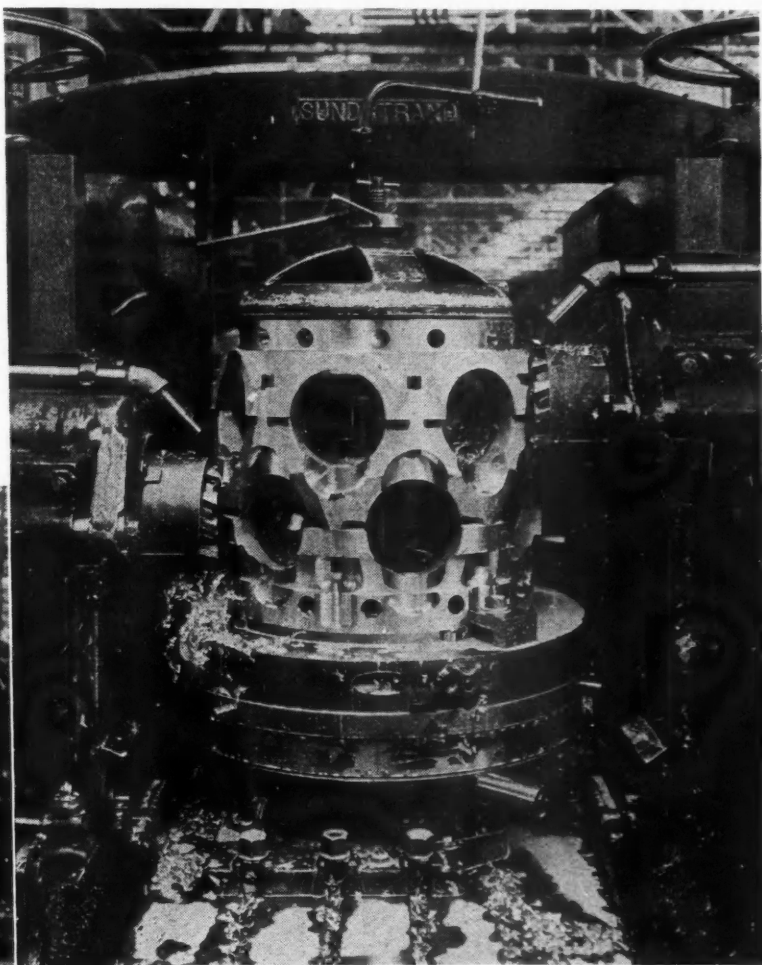
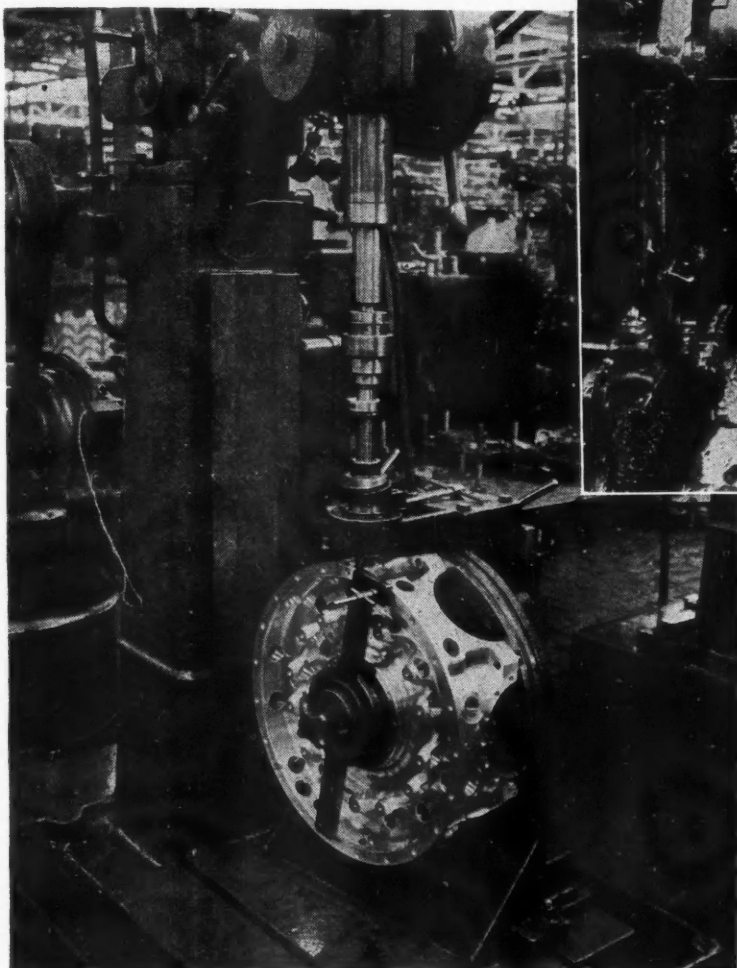
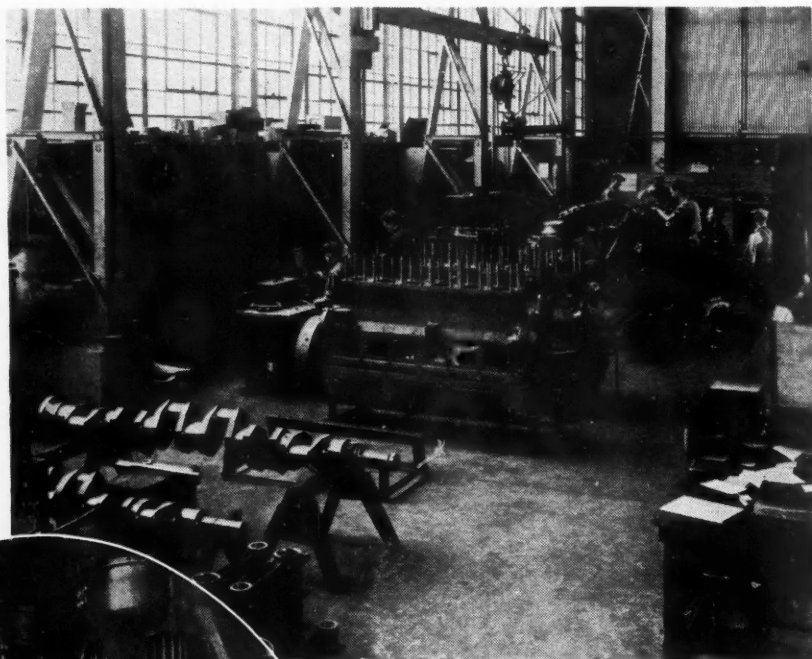


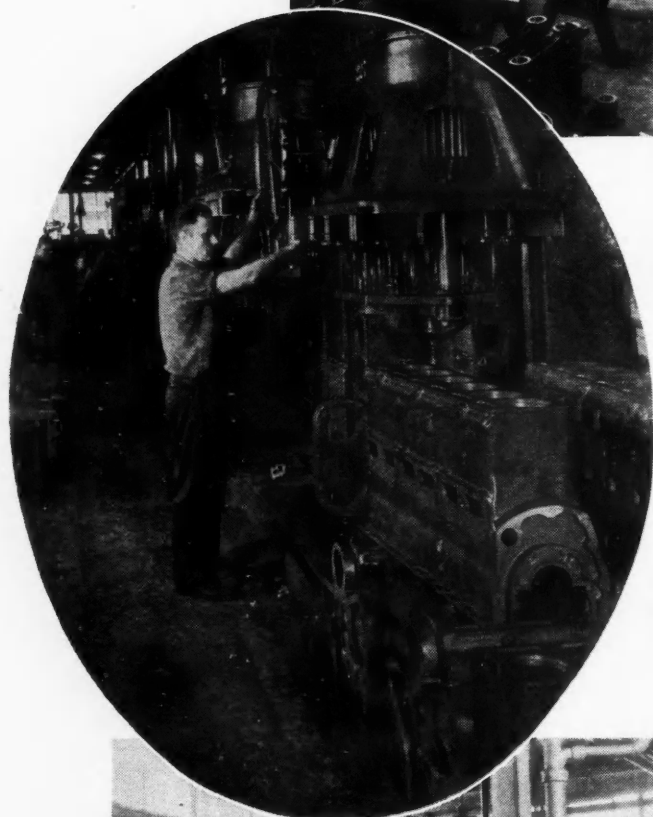
Fig. 20—(Above) Sundstrand machine set up for milling crankcases. The specially designed machine must produce accurately and smoothly the milled pads for the cylinder bolt-down surfaces. It is arranged to accommodate a number of different crankcase designs.

Fig. 21—(Left) Special fixture attached to a Leland-Gifford machine for drilling tappet guide holes in the front and rear section of the two-row crankcase. In this photograph the rear section is shown mounted in place. Work is located diametrically by a plug which fits into the main bearing liner. Angular location is determined by a plug fitted through the strap visible on the front of the case into a dowel hole in the crankcase section.

Larger in-line engines as well as the new V-type railcar engine are erected in a bay of the new building.



By  
**Joseph  
Geschelin**



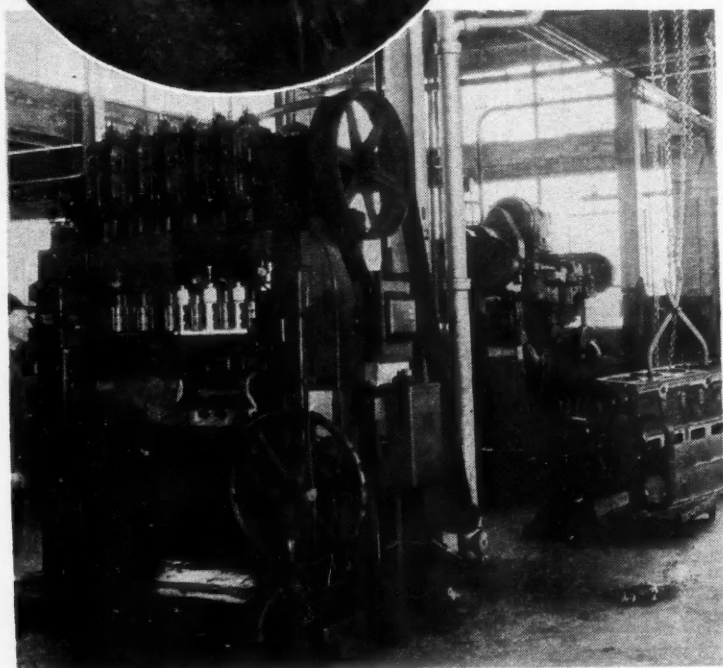
Natco multiple drill presses are used for drilling holes in the Model H cylinder blocks

## Cummins Diesel

**C**ONSIDERING the recent progress of the automotive diesel engine, it is of more than passing interest to learn something of how the modern Diesel is manufactured. For this purpose, we have selected the Cummins Engine Co., Columbus, Ind., as a unique example of an engine builder who pioneered the high speed Diesel in the U. S. A. and approximately 40 per cent of their production is automotive engines.

Starting from scratch, Cummins now produces a line of high-speed diesel engines ranging from 20 to 500 hp. Flexibility and versatility are by-words with Cummins, for these engines will be found on transcontinental buses, heavy-duty trucks, on tugs and yachts, on tractors, on high-speed motorized railroad trains, and on all manner of industrial equipment.

When the writer first visited the Cummins plant late in 1932, the company had just embarked upon an ambi-



Boring cylinder liner holes in the Model H automotive diesel block on a Moline Hole Hog.

## THIS IS THE SEVENTEENTH IN THE SERIES OF MONTHLY PRODUCTION FEATURES.

tious program of production of the four and six-cylinder truck engines. Today the plant is to be expanded in an effort to keep pace with the rapidly growing demand for Diesel power. Recently, they built two new buildings—one housing the new experimental department; the other for storage and large industrial engine assembly. However, since the plant still is limited to a production of 15 truck engines per day, further expansion is planned on before the end of the year to improve the production problem.

It is a matter of note that Cummins has the distinction of being one of the few American stock engine manufacturers building their own fuel pump and

injection system. This entails some extraordinarily precise machining and fitting which is quite unmatched by any operations incident to the building of gasoline engines.

Careful planning and arrangement of equipment and departments have produced an excellent pattern for a relatively moderate volume of production. Manufacturing equipment, in the main, is of universal type and capable of producing a wide variety of parts with but a simple set-up. In some cases, as for example in the case of fuel pump bodies,

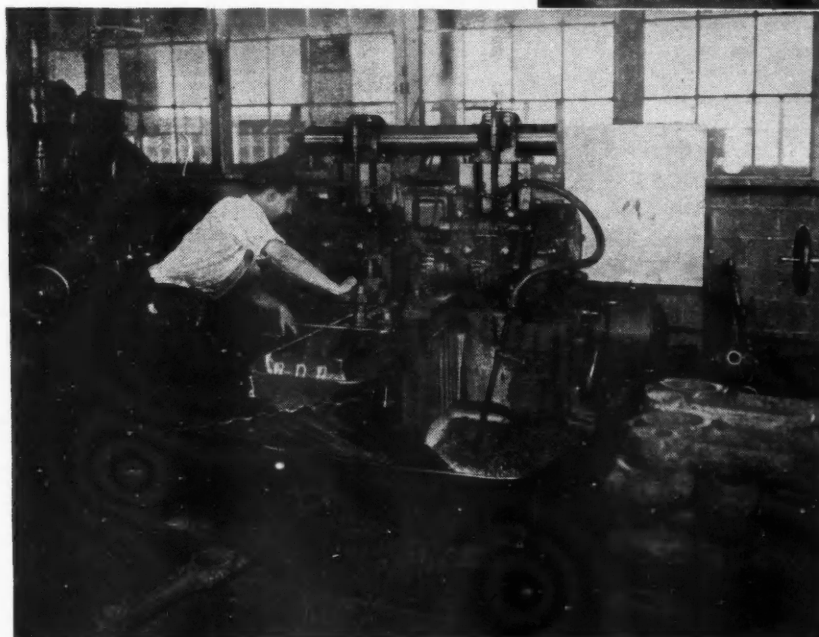
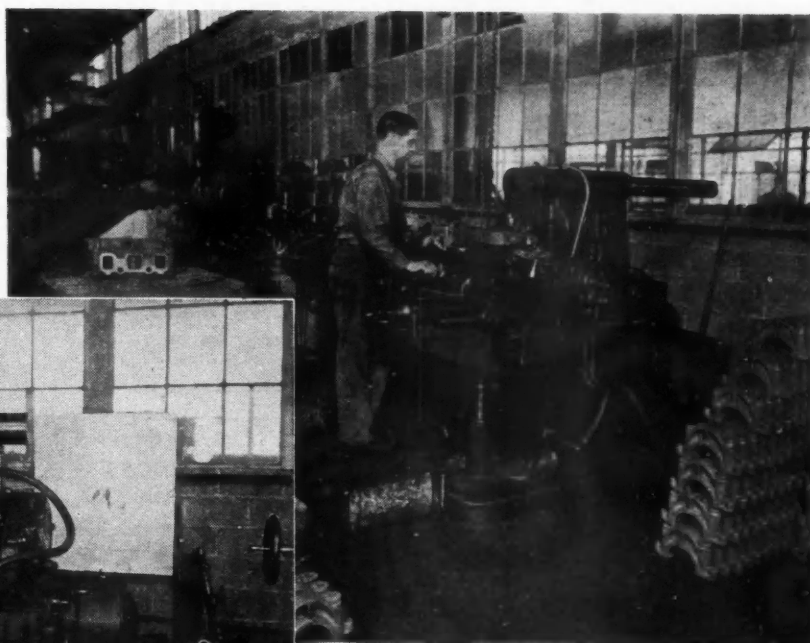
the same machine is used for the entire range of pump sizes.

In this type of operation, jig and fixture design plays a prominent role and careful tool design holds the key to economy and favorable costs.

Roughly, the plant may be divided into a number of production departments, each having a specific responsibility. First there is the large general machine shop which handles the bulk of parts production, including fuel pump bodies and parts, rough-machining of injector bodies, rocker arms, etc.

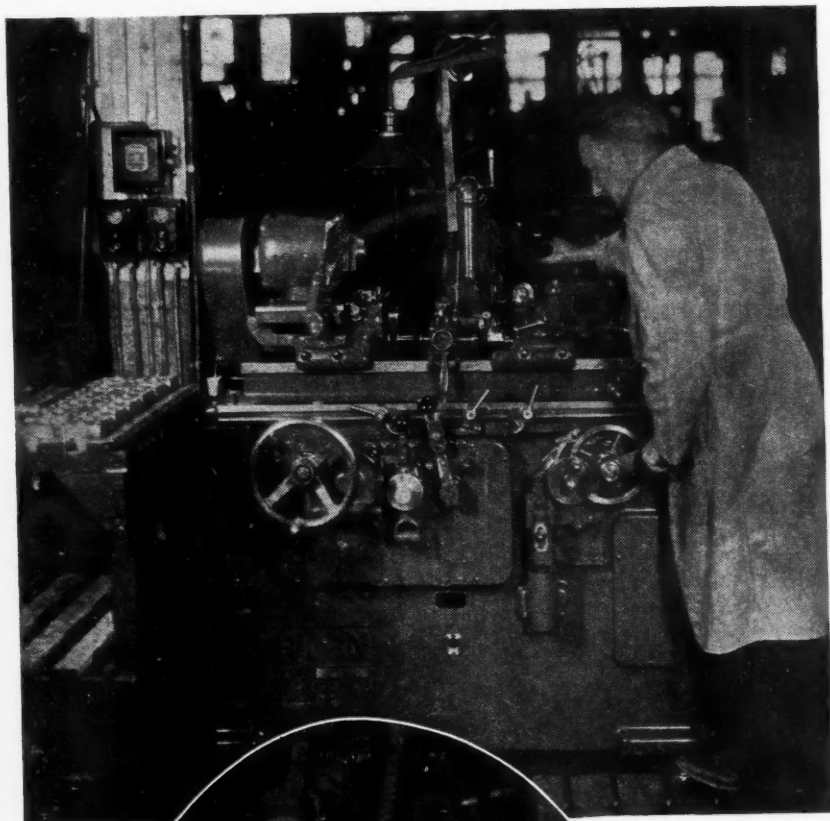
# Production Carefully Planned

(Right) Joint face of main bearing caps is milled on the Milwaukee mill shown here



(Left) Cincinnati milling machine is set up for straddle-milling bearing faces of connecting rods





Selective fitting of injector plungers in bodies is facilitated by this recently installed Norton precision grinding machine. Perfection of surface finish is an important attribute to this operation

The very heart of the Cummins engine is its fuel distributor. This Heald surface grinder is used to finish-grind the contact face of the distributor disc housing cover. Following this operation, the disc is machine-lapped, and then hand-lapped to produce a perfect mating surface

Another of the major divisions is the machine shop for the four- and six-cylinder blocks. This has a line of more or less unit type machinery which is flexible in character and may be changed without great expense to accommodate any changes in product design. This department also contains a section devoted to the production of connecting rods, and another to cylinder heads.

The connecting rod line is notable for its simplicity and great flexibility since it accommodates, interchangeably, all the variety of sizes used in the entire line.

On the second floor of the main machine shop building are two major activities. One department is devoted to the assembly and testing of fuel pumps; the other for machining, fitting, assembly, and testing of the injectors.

The larger of the two new buildings mentioned earlier is devoted to certain related activities. One section is used for storage of many parts used here. Another section takes care of the assembly of large industrial units. There is a large bay fitted with the latest type of large precision boring and milling machines for the machining of the big cylinder blocks for the 500 hp. V-12 rail-car engines. The assembly line for the large engines also is housed in this building.

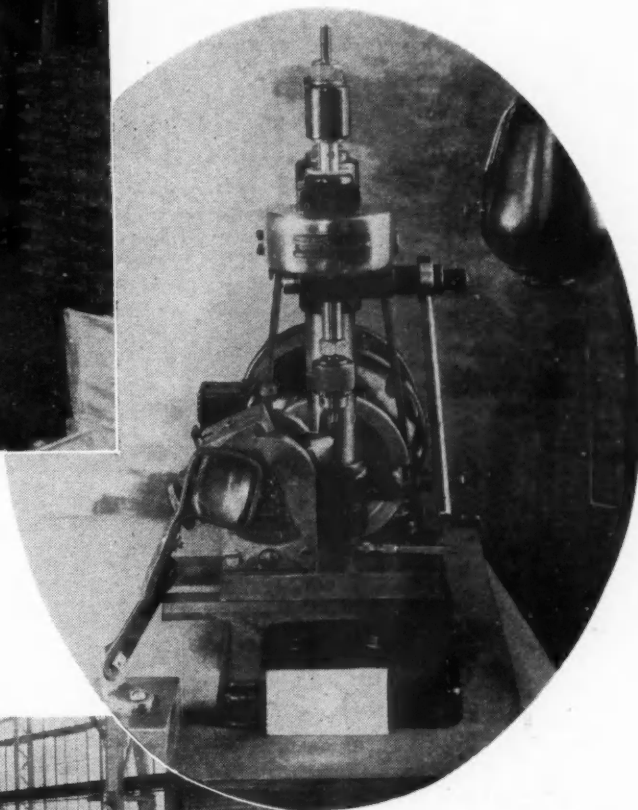
One of the most interesting features in the machining of the V-12 cylinder block is the use of a huge Davis boring tool for cylinder bores. This one tool performs the operations of rough-and-finish-boring, counterboring, and recessing in one set up. Davis expanding blocks are used to rough and finish bore and counterbore all diameters complete in one pass. The tool is constructed with a roller bearing stop collar for accurately gauging the depth of the counterbore.

## Factory Executive Personnel

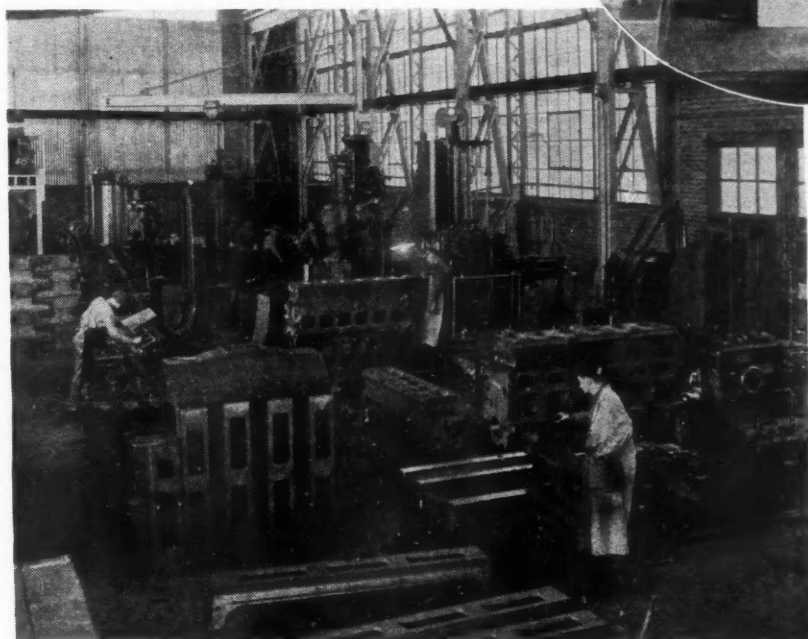
V. W. McMullen, Manufacturing Manager	Chas. Braden....Foreman Test Dept.
F. E. Sprague...Production Manager	Robert Thurston, Foreman Small Engine Assembly
W. Somers.....Chief Inspector	M. C. Greenleaf..Foreman Large Engine Assembly
R. C. Dick.....Methods & Time Study	R. C. McDonald..Foreman Small Parts Machine shop
C. R. Fox.....Superintendent	D. Tull.....Foreman Large Parts Machine Shop
J. Cowles.....Foreman Injector Dept.	J. Coles.....Foreman Tool Room
S. Robbins.....Foreman Fuel Pump Dept.	



Inspecting connecting rod forgings. This set-up includes a Magnaflux machine for exploring soundness



(Above) Unique but simple set-up was developed for drilling the five, 0.005 in. diametering holes in the injector cap. It is necessary to use a special drill which is rotated at 10,500 r.p.m. Note the vernier with magnifying glass used for precise angular setting of the work



(Left) Battery of heavy-duty precision boring and milling machines installed in the new building for machining big diesel blocks. A Universal boring machine may be seen in the foreground

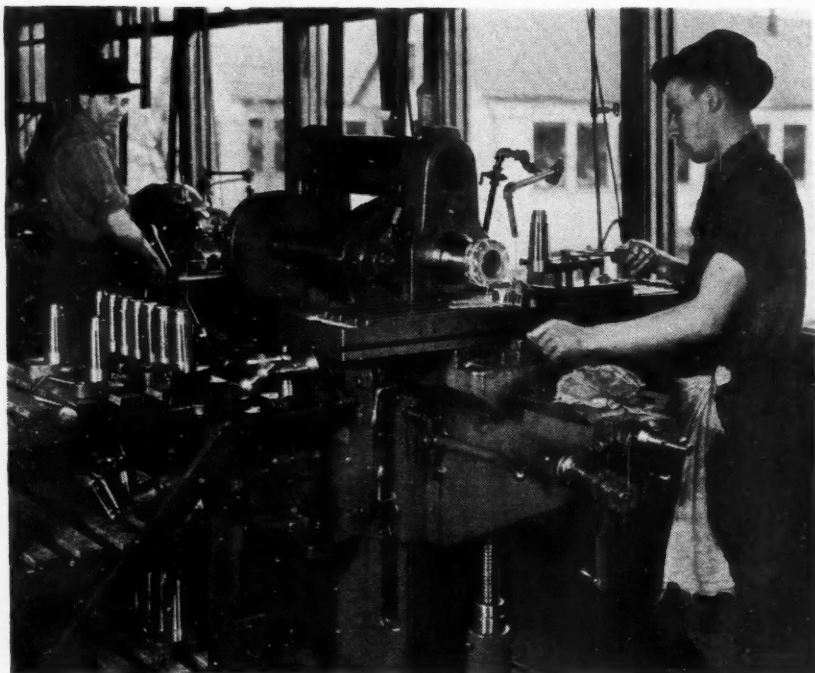
After the boring operations, the tool is moved back and a split spacer collar is inserted, after which the grooving operation is performed. All three of the packing ring grooves are recessed at the same time. Due to the size of the tool, and the nature of the work, it was necessary to rear pilot the bar in the

finish machined hole. The front pilot is supported in a rotating bushing.

The second of the new buildings is a small structure devoted exclusively to experimental work and C. L. Cummins makes this place his headquarters. Among other things, the experimental department boasts a fine machine shop

fitted with the very latest type of tool room equipment.

With but few exceptions, Cummins makes all of the parts that go into the entire line of engines. Many of the parts require very close limits and in that respect differ largely from the usual practice in gasoline engine plants.



Milling inlet and drain connection of injector on No. 2 Cincinnati milling machine. This is one of a series of preliminary machining operations prior to tin-plating and the final machining

The injector, for example, is a very fussy part. It comes in the rough as a drop forging. The forging is rough-machined in the general machine shop; then it takes a number of finishing operations in the injector department.

After being completely finished, the injector bodies are returned to the machine shop where they are fitted with plungers. The procedure here is to grind the plunger diameter on a Norton grinder as a selective fit for each individual injector bore. Even this does not satisfy the acceptance standard. The injector bodies with fitted plungers come back to the injector assembly department and go through the various stages of selective assembly. Then the completed injector is tested on a special machine which measures plunger leakage under an oil pressure of 3000 lb. per sq. in. If the leakage exceeds

## Factory Routing, Cylinder Block

OPERATION	EQUIPMENT	OPERATION	EQUIPMENT
Mill top and bottom and main bearing pads, rough and finish mill bearing cap recess	Ingersoll milling machine	Counterbore 21 stud holes, ream 14 stud holes, tap 14 stud holes	Cincinnati radial drill press
Drill and ream (2) locating holes to $\frac{5}{8}$ in. diameter	Radial drill press	Drill 8 o'l lines, drill 4 holes, tap 2 $\frac{7}{16}$ in. U.S.S.	Hammond high speed drill press
Bore main bearings, half-hole (rough)	Barnes boring mill	Drill 10 holes	Cincinnati radial drill press
Bore main bearings, half-hole (semi-finish)	Barnes boring mill	Tap 27 holes, drill 17 holes, ream 8 holes, bore 1 hole	Hammond high speed drill press
Rough mill ends	Lucas duplex milling machine	Drill 55/64 in. through and ream $\frac{7}{8}$ in. through and counterbore $\frac{7}{8}$ x $\frac{1}{8}$ in. deep. Drill "W" hole (0.386 in.) x $\frac{13}{16}$ in. deep and tap $\frac{7}{16}$ in. S.A.E. to bottom. Drill (1) hole $\frac{9}{16}$ in. through. Face off main bearing $2\frac{1}{2}$ in. diameter. Spot face bottom flange $\frac{7}{8}$ in. diameter. Tap (9) holes $\frac{5}{8}$ in. S.A.E. x $1\frac{1}{4}$ in. deep. Tap (8) holes $\frac{3}{8}$ in. S.A.E. x $\frac{3}{4}$ in. deep.	Cincinnati radial drill press
Finish mill ends	Lucas duplex milling machine	Drill (4) "Q" holes (0.332 in.) x 1 in. deep. Drill (1) 55/64 in. through and ream $\frac{7}{8}$ in. through. Counterbore $1\frac{1}{16}$ in. diameter x $\frac{5}{8}$ in. deep. Face off idler gear, main bearing, and camshaft. Drill (1) hole $1\frac{3}{16}$ x $3\frac{3}{4}$ in. deep and ream $1\frac{1}{4}$ x 3 in. deep. Tap (8) holes $\frac{5}{8}$ S.A.E. x $\frac{3}{4}$ in. deep. Tap (19) holes $\frac{7}{16}$ in. S.A.E. x $\frac{7}{8}$ in. deep. Drill (1) hole $\frac{7}{16}$ in. through and tap $\frac{1}{4}$ in. pipe	Cincinnati radial drill press
Rough drill camshaft holes	Rockford boring machine	Countersink 18 stud holes, drill 10 holes, ream 6 holes	Cincinnati radial drill press
Bore camshaft holes	Cleveland boring mill		
Mill both sides complete	No. 4 Cincinnati horizontal milling machine		
Bore and face gear centers	Cleveland boring mill		
Bore cylinder liner holes	Moline hole hog		
Face sides of main bearing	Rockford boring mill		
Drill gear housing end	Natco multiple drill press		
Drill flywheel end	Natco multiple drill press		
Drill camshaft side	Natco multiple drill press		
Drill top holes	Natco multiple drill press		
Drill bottom flange	Natco multiple drill press		
Drill main bearing stud holes	Natco multiple drill press		



## Factory Routing, Connecting Rod

OPERATION	EQUIPMENT
Inspect and magnuflux, weigh and date received	
Rough - bore crank - end to 3 1/16 in. diameter and pin end to 1 53/64 in. diameter	Norton drill press
Straddle mill crank end to 2.386 in. dimension	Cincinnati duplex miller
Straddle mill pin end to 2 1/4 in. diameter	
Rough and finish-bore pin end to 2.204 in. diameter	Moline hole hog
Broach pin end to 2.2505 in. diameter	Lapointe broach machine
Mill locating pads to 4.808-4.812 in.	Pratt & Whitney miller

OPERATION	EQUIPMENT
Mill bolt pads to dimensions 3 1/32 in. mill nut pads to dimension 2 21/32 in. and split and burr	Cincinnati milling machine
Grind end faces on cap	Abrasive Machine Tool Co.
Drill (2) 19/32 in. holes in rod	Manning, Maxwell & Moore drill press
Drill (2) 19/32 in. holes in cap	Manning, Maxwell & Moore drill press
Mill end faces on rod	Brown & Sharpe horizontal milling machine
Grind end face of rod	Abrasive Machine Tool Co.
Bore half-hole in rod and cap and chamfer	Bement boring mill
Drill 1/4 in. oil hole and 17/64 in.	Henry & Wright drill press

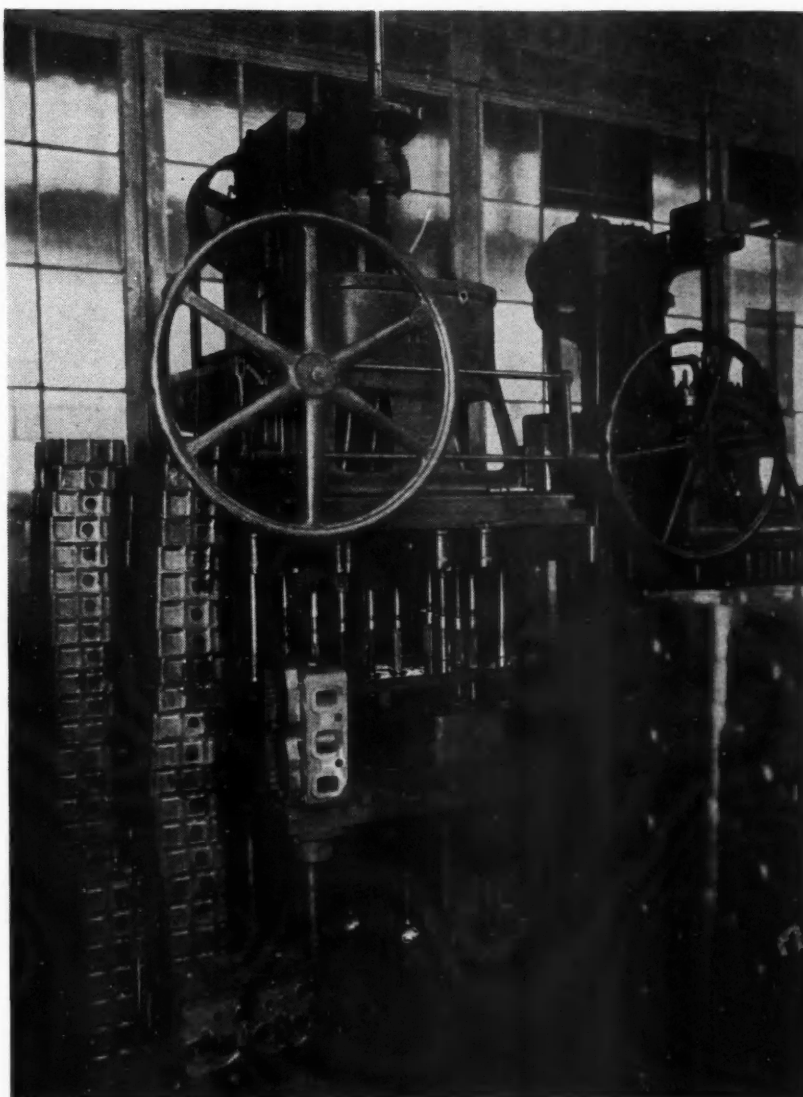
the quality level, the plunger must be replaced by one having a better fit.

Actually, the clearance between the plunger and the broached bore is so minute that it would be impossible to measure it accurately.

Another very fussy part is the distributor for the fuel pump. The two steel disks forming the distributor must be perfectly planed and polished so as to produce what might be termed a sucking fit. This delicacy of fit is essential when it is considered that the two elements are in intimate contact with practically no lubrication and yet have a relatively high rubbing speed with respect to each other. Because of these conditions, friction must be held to a negligible value.

In preparation for this kind of service, the disks are machined in the usual manner; then ground on a Heald vertical surface grinder; then lapped on a Norton lapping machine; and then hand-lapped on a surface plate. When completed, the mating surfaces can be brought together with a wringing fit.

Another practice that differs quite radically from that of other engine

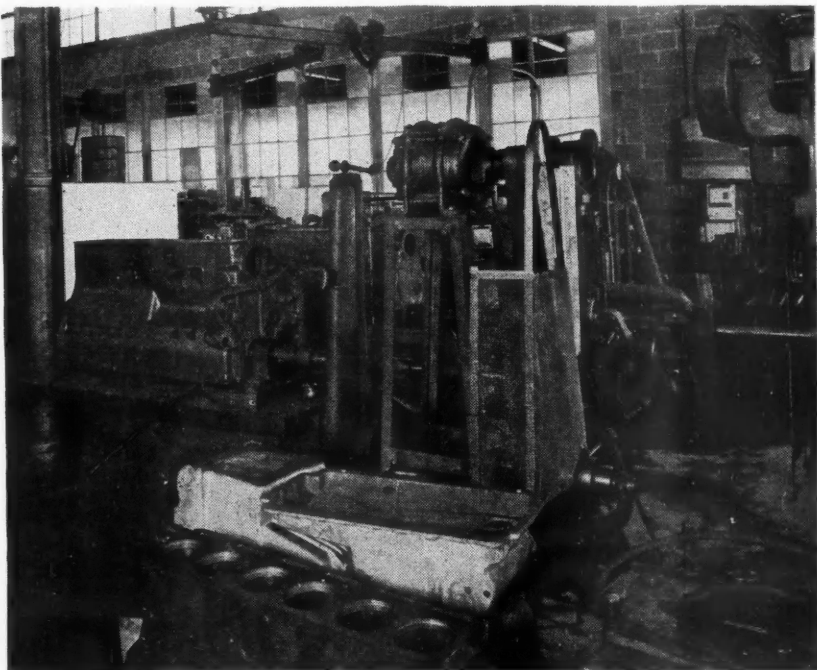


**Natco multiple spindle drilling set-up for machining cylinder heads and rocker arm housings**

builders is the installation of cylinder liners. Cummins uses wet liners which are dropped into place and retained without shrink or press fits. Consequently, the liners require no further operations after assembly, i.e., no honing or lapping to correct for press fit distortion.

For the benefit of those who may be interested in following the details of some of the major parts production, we have reproduced complete factory routings giving all the operations on each of the following parts—cylinder block, connecting rod, cylinder head, and injector body. These routings tell the story completely.

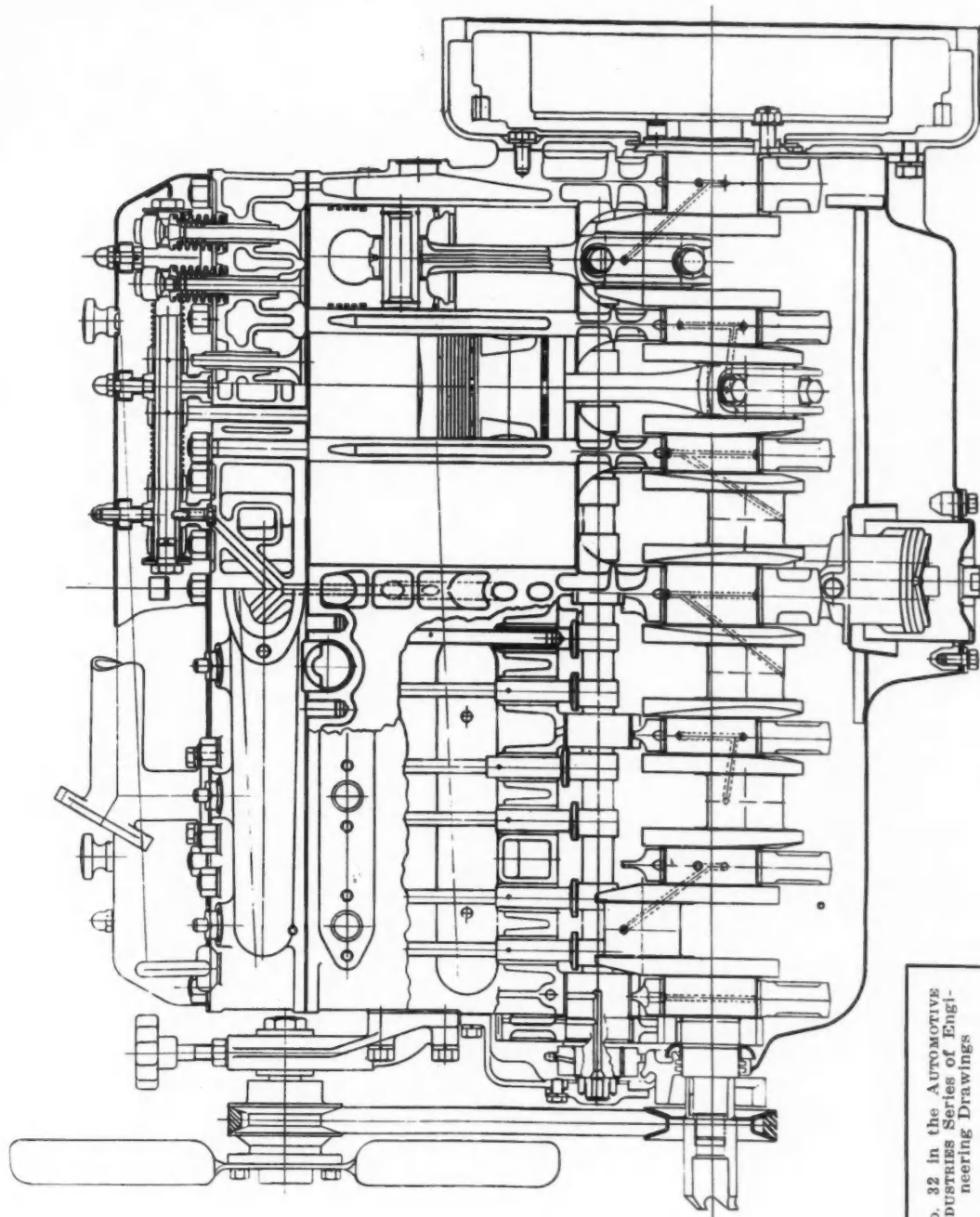
**Barnes heavy-duty boring mill with massive fixture is used for line boring main bearing holes in Model H Block**



## Factory Routing, Cylinder Head

OPERATION	EQUIPMENT	OPERATION	EQUIPMENT
Mill manifold face	Milwaukee milling machine	Drill (2) dowel pin holes 23/64 x 3/8 in. deep and ream 0.375 in.	
Straddle mill top and bottom faces. Rough cut	Cincinnati duplex miller	Drill (2) 17/32 x 7/8 in. deep and tap 5/8 U.S.S. x 7/8 in. deep	
Straddle mill top and bottom faces. Finish cuts	Cincinnati duplex miller	Drill (4) 11/16 in. through and spot face 13/16 in.	Edlund 3 - spindle high speed drill press
Profile mill injector and manifold pads on top	Brown & Sharpe No. 3 vertical milling machine	Drill (1) 27/64 x 11/16 in. deep	Cincinnati radial drill press
Bore 1.686-1.688 in. dia. Cut 1 1/4 dia. x 5/32 in. grooves.	Colburn heavy duty drill press	Drill (1) 1/4 in. through	
Undercut 1 5/16 dia. x 3/4 in. and machine 60 deg. angle, two injector sleeve holes.		Tap (11) 1/2 in. U.S.S. to bottom	
Drill (16) holes. Drill (4) letter I x 3/4 in. deep.	Natco multiple drill press	Tap (4) 5/16 in. S.A.E. to bottom	
Ream (4) valve seat holes. Drill (4) valve guide holes	Natco multiple drill press	Drill (1) 21/32 in. (one-half through)	
Drill (1) 17/64 x 9/16 in. deep and tap 5/16 S.A.E. x 3/8 in. deep	Edlund 3 - spindle high speed drill press	Drill (2) 7/8 in. through and counterbore 1 x 1/8 in. deep	
Drill (1) 11/32 x 1 1/2 in. deep. Drill (1) 7/8 in. through and counterbore 1 x 1/8 in. deep. Drill (1) 7/16 in. through and tap 1/4 in. pipe. Drill (2) 1/8 in. through		Drill (1) 21/32 in. (one-half through) and counterbore 15/16 x 1/8 in. deep. Drill (8) 9/16 in. through	
Drill (1) 7/8 in. through and counterbore 1 x 1/8 in. deep. Drill (2) dowel pin holes 23/64 x 3/8 in. deep and ream. Drill (2) and tap 5/8 U.S.S. x 7/8 in. deep.	Edlund 3 - spindle high speed drill press	Seat (2) Inj. sleeve seals	
Drill (2) 7/8 in. through and counterbore 1 x 1/8 in. deep.	Edlund 3 - spindle high speed drill press	Drill (6) 15/16 in. through	
		Drill (2) dowel pin holes 23/64 x 3/8 in. deep and ream 0.375 in.	
		Spotface (6) stud holes.	
		Cut water passage.	

# Hercules Diesel Engine, Model DJXB



No. 32 in the AUTOMOTIVE INDUSTRIES Series of Engineering Drawings

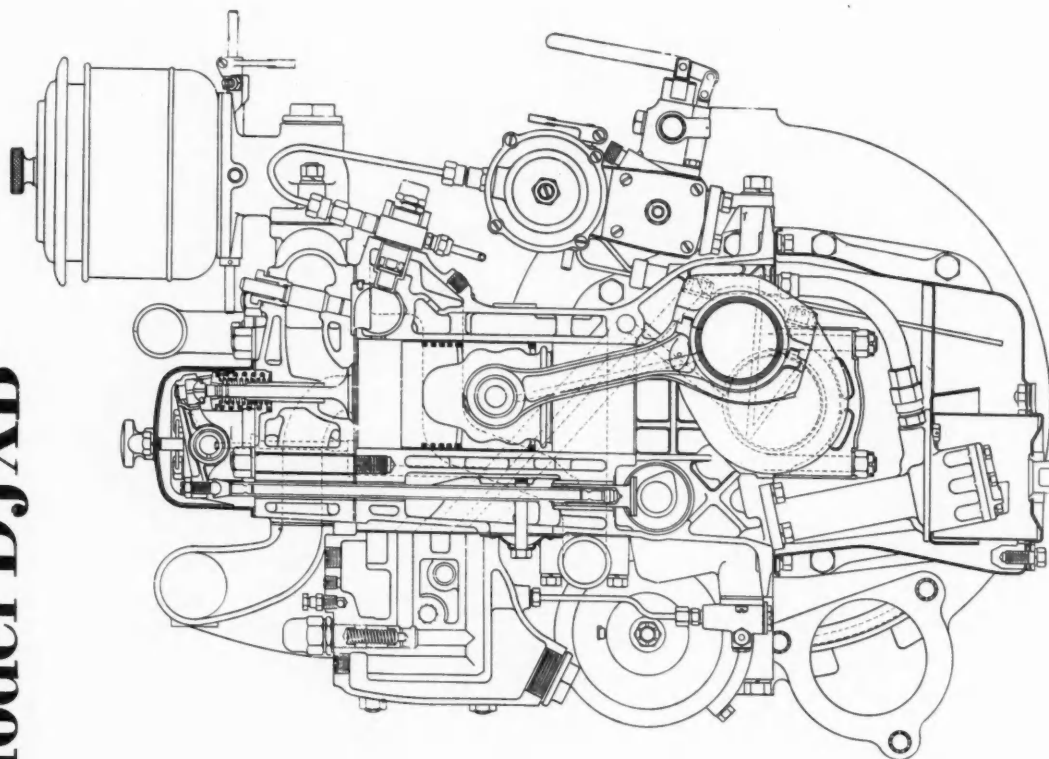
This six-cylinder engine has a bore of  $3\frac{1}{2}$  in. and a stroke of  $4\frac{1}{2}$  in., and therefore a piston displacement of 260 cu. in. It develops 75 hp. at 2500 r.p.m., 65 hp. at 2000 r.p.m. and 51 hp. at 1500 r.p.m.

The six cylinders and crankcase are in a single casting of electric-furnace molybdenum-alloy iron. Valves are located in the cylinder head, and the exhaust valves are made of silicon-chromium steel. Pistons are of aluminum alloy and piston pins are of the floating type. The seven-bearing crankshaft has surface-hardened bearings. All main bearings are of 3 in. diameter. Bearing lengths are as follows: Front,  $1\frac{1}{4}$  in.; center,  $2\frac{1}{32}$  in.; rear,  $2\frac{1}{16}$  in.; intermediary,  $1\frac{7}{32}$  in. Crankpin bearings are of  $2\frac{1}{2}$  in. diameter by  $1\frac{25}{32}$  in. length. The connecting-rod center-to-center length is 8 in. It will be seen that the connecting-rod head is split at an angle, which makes it possible to use a very rigid head and still withdraw the connecting rod through the cylinder. The

(Continued on next page)



# Hercules Diesel Engine, Model DJXB



*(Continued from preceding page)*

camshaft, which is driven through helical gears, is supported in four bearings, all of 2 1/16 in. diameter.

The feature of the engine is the arrangement of the spherical combustion chamber with tangential inlet at the side of the cylinder. Owing to the tangential inlet, there is considerable turbulence in this chamber when the fuel is sprayed into it, and this turbulence is increased by the fact that the inlet to the chamber is partly obstructed by the piston as it nears the end of its up-stroke, which increases the velocity of the air entering the chamber.

The engine is equipped with an oil-bath type of air cleaner, a plunger-type fuel-injection pump with integral fuel transfer pump and vacuum-type governor. The injection nozzles are of the pintle type. It will be seen from the transverse section that the engine is equipped with electric heating units in the inlet manifold as an aid in cold starting. The exhaust manifold, which is located on the right-hand side looking at the flywheel, has an internal diameter of 2 1/4 in. Lubrication is by force feed to all main, connecting-rod, piston-pin, and rocker-arm bearings. An oil filter is shown mounted on the right-hand side of the engine, where the water pump and electric starter are also located. Provision is made for the installation of a 3 or 6-cu. ft. air compressor or vacuum pump. The engine with fuel-handling equipment weighs 875 lb.

## 1938 Car Design Trend Emerges

(Continued from page 1)

the way for next season. There has been a good reaction from the field on the new four-speed transmission.

In recent years the overdrive has become important adjunct on many makes of cars and holds much of popular appeal due to improved performance, better fuel economy, and longer life of chassis units. In this picture is the Columbia two-speed axle which gives the overdrive effect at the axle shaft instead of at the transmission. This unit is available as a replacement job on the Ford V-8 and has been approved as optional equipment at the factory on the Lincoln-Zephyr.

There is another movement afoot that holds interesting possibilities. It is understood that three independents, and maybe one other large organization, already have released for production a power shifting (remote control) device which is used in conjunction with the conventional transmission with or without overdrive. This control eliminates the usual gear shift lever as on Hudson and Terraplane when using the Bendix finger-tip control. The point is that with power shifting, particularly in conjunction with overdrive, it is possible to demonstrate performance approaching that of a semi-automatic transmission. Where power shifting is adopted, there should be seen some form of the inverted transmission with cover at the bottom as on LaSalle and Cadillac last season.

### Suspensions

At least two car manufacturers are making a radical change in rear spring suspension. It should be noted that neither of the companies has any intention of bringing out independent springing at the four corners.

One of the makes (now an open secret that it is a General Motors car) has coil springs at rear as well as at the front, eliminating the rear leaf springs. However, the rear axle is conventional and it will use the same torque tube drive. The big coil springs lend themselves to the application of the new low-pressure direct-acting shock absorbers. Lateral stability is provided by the introduction of a sway-bar of special design.

The other car builder, an independent, will use leaf springs of special design incorporating some features that provide controlled frictionless characteristics.

In both cases it is the aim of the designers to produce a suspension having the characteristics considered most desirable with independent springing all round but without its present disadvantages.

### Engines

Most makes are entering the new season with time-tried units some of which will be ready for redesign next year. It seems quite probable that the 1938 models will feature many detail im-

provements to provide better performance and in some cases better fuel economy. For this reason some slight increase in displacement and in some instances an increase in compression ratio is expected. So far as the latter point is concerned, the impression is that most engines have just about reached the limit of compression ratio with present fuels, and the only ones to boost compression ratio will be those whose present rating is below the top limit.

One well-known engine designer has ventured the opinion that current engine design appears to be limited by fuel distribution and the quality of the charge to individual cylinders. He feels that

future development must look to some form of solid fuel injection with which both quality and distribution of charge may be positively controlled.

The valve-in-head engine is holding its own and is being continued on cars that have featured this design. However, at least one producer is striving for better combustion control, using a formed combustion chamber. The pendulum seems to be swinging to more aluminum pistons and more of the newcomers are going in for tin-plating. Our source of information intimates that this coming season may see the end of cast iron pistons on one or more cars.

One of the high production low-priced



Photo Courtesy Union Pacific Railroad

## Vacation Without A Worry

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# RYERSON

cars has given much attention to its carburetion and ignition and its engineers have succeeded in picking up about 1½ miles per gallon.

So far as can be learned, Packard remains as the only user of the 10 mm. spark plug. Packard has had great success with this plug and it seems only a question of time before other engineers will adopt it. The tendency certainly is in that direction judging by the fact that many 1938 cars will change from 18 mm. to 14 mm.

#### Other Changes

Every manufacturer who adopted hypoid rear ends last year appears well

satisfied with the service history. In fact, reports from the field are better than ever before and noise particularly has elicited negligible comment. One important producer who had hypoids only on two medium-priced models is expected to carry them throughout the entire line of four models.

Steering gears are expected to exhibit some changes representing unusual advances in practice. One low-priced car will have a new gear that is designed to eliminate wind wander at high speeds. A higher-priced car has adopted another form of gear that seems to answer all the requirements of good control coupled with perfect geometry.

One of the unexpected developments promises to be the first big change in battery application in many years. Quite a few makes are preparing to house the battery under the hood, which in itself is not a complete novelty. The novelty comes in the fact that the old accustomed form of the battery has been changed to accommodate it to a mounting on the dash. The new battery will have the cells assembled end-to-end making a long, narrow rectangular package which will be mounted in some convenient location where it can be properly ventilated and cooled.

There is a continuing trend to a still further simplification of chassis lubrication. One popular low-priced car accomplishes this objective by increasing the number of anti-friction bearings, using needle bearings, specifically.

No passenger car builder has found it practical or desirable at this stage to make any changes in chassis design to accommodate the trailer. This is not due to any inertia on the part of the engineers, but is due to the present lack of standardization, particularly with respect to hitches and weight distribution within the trailer.

## Concours Reactionary

### Paris Competition Brings Few Extreme Cars

Reaction against extreme models, colors mostly of medium value and color bands and belting of chromium-plated metal of moderate size were the outstanding features of the two Concours d'Elegance for Automobiles, held June 15 and 25 at the Bois de Boulogne, Paris, according to P. H. Chase, color specialist of the Paris office of the Duco color advisory service.

A survey of the exhibits showed that black and green vied for first choice in color, the former well in advance of other colors at the June 15 display, while green took first place on June 25, with black a close second.

Blue followed black in the popularity of the colors at the June 15 exhibit, with green, ivory, brown, gray, red and yellow in the order given. However, at the June 25 exhibit, the order of color presentation was somewhat altered with green leading, then followed black, blue, ivory, red, brown and gray.

At neither of the exhibits were black fenders used except on black cars, the fenders in virtually every case being the same color as the car. Very few of them were in lighter contrasting shades or in darker shades of the car colors, showing that the popular trend in that respect is being maintained.

Brown had an unusually prominent position in the list of color percentages, according to Mr. Chase, because that color is often used as a secondary color for decorations, he explains. Ivory was fairly well represented, as is usually the case on competitions of the kind. A great many cars, notably those finished in gray, presented metallic lustre effects.



## METAL SPHERES WITH LAPPED SURFACES

Strom Steel Balls possess that extra measure of quality by means of which the ultimate in ball bearing performance is achieved.

This special lapping practice is exclusive with Strom.

Physical soundness — correct hardness — size accuracy and sphericity are guaranteed in all Strom Balls.

Other types of balls — STAINLESS STEEL — MONEL — BRASS & BRONZE — are also available in all standard sizes. Write for full details.

# Strom

## STEEL BALL CO.

1850 So. 54th Avenue, Cicero, Ill.

*The largest independent and exclusive Metal Ball Manufacturer*



Some novel designs were shown in decorations which were carried out either in contrasting colors or in chromium plate, taking the shape of curved stripes under the windows or running down the back fenders and sweeping up to the front of the hood. Some convertible cars had tops of colored fabric contrasting with the color of the car.

In general, lines did not show any trend toward decided changes other than that accentuated airflow designs appeared to be on the wane. Aerodynamic principles have, however, not been forgotten since great care seems to have been taken to suppress sharp curves and anything that might form an obstacle to the air.

The use of leather upholstery is still on the increase, but an interesting feature, also, was an increase in the use of leather substitutes. Popularity of pressed steel wheels and of wire wheels is growing.

There were 165 cars entered in the two exhibits, American makes being represented by Packard, Lincoln, Chrysler, Studebaker and Dodge.

## Industry Ahead of Schedule

(Continued from page 1)

month since the plants have been on a four-day week since first of June. All companies lose one working day next week, with the July 4 holiday observed on Monday. This cuts the number of working days in July for companies on a five-day week to 21 compared with 22 in June.

While retail sales have held up strongly this far into the summer, there is a suggestion of seasonal decline in the latest delivery figures reported to the factories. Nine companies reporting by 10-day periods showed a drop of 12 per cent in deliveries from the first to the second 10 days of June. Only three of the nine companies showed gains. Some of the declines are explained by shortage of cars resulting from interruptions to operations earlier in the month but there still remains evidence of a softening in retail demand in line with the advanced season.

William S. Knudsen, president of General Motors, announced that the millionth motor vehicle of the calendar year built by its United States and Canadian factories was turned out June 24 by General Motors Corporation. The millionth car in 1936 was produced on June 15, just seven working days earlier than it was produced this year.

Sales of Buick motor cars during the second 10 days of June totaled 6,569 units compared with 3,988 in the corresponding period of June last year, a gain of 2,581 cars or 64.4 per cent, it was announced by W. F. Hufstader, general sales manager. Total sales of used cars during the second 10 day period of June totaled 10,595 units with the used car stocks remaining unchanged from the previous period at approximately 31,000 cars. At the rate of turnover maintained thus far this year this represented 28 days' supply, Mr. Hufstader said.

Paul G. Hoffman, president of The Studebaker Corporation, reports the sale of 5780 passenger cars and trucks in the first 20 days of June compared with 5052 in the corresponding period of June, 1936, an increase of 14 per cent. For the year to date

sales were 52,279 compared with 45,063 last year, an increase of 16 per cent. Studebaker truck and commercial car sales during the first five months of 1937 were 75.9 per cent greater than during the corresponding period in 1936, according to Geo. D. Keller, vice-president in charge of sales.

Diamond T Motor Car Co. sold 6626 trucks in the first five months of this year against 5756 for the like 1936 period.

Sales of Hudson and Terraplane cars for the three weeks ended June 19 totaled 8932 cars and sales showed a steady upward trend during that period, according to W. R. Tracy, vice-president in charge of sales.

## U. S. Tire Ready Soon

The U. S. Tire, a popularly priced quality tire built especially for independent dealers, will soon be introduced by U. S. Tire Dealers

Mutual Corp., as a companion line to U. S. Royal and U. S. Royal Master.

Identified on the sidewall with the marking "I.D." (Independent Dealers), the U. S. Tire will be available in a complete range of sizes for both passenger cars and trucks.

## Frigidaire in New Lines

Frigidaire division, General Motors Corporation, will broaden its manufacturing and marketing activity in the near future with entrance into the general appliance field, E. G. Blechler, general manager, announced.

First appliances to augment the divisions domestic and commercial refrigeration equipment will be electric ranges and electric washers, Mr. Blechler said. Complete lines of both products are in the process of development and will go into production in the not too distant future, he said.

# CONSISTENT Performance

UNDER VARYING ROAD, LOAD  
AND WEATHER CONDITIONS  
BECAUSE . . .

✓ The disc areas exposed to the jacket water are so arranged that the hydrostatic forces on the valve discs neutralize themselves.

✓ An external balancing disc, which neutralizes the hydro-dynamic forces, holds operating temperatures the same as still water set temperatures.

✓ A special machine operation makes the valves seat tight and keeps bleed under definite control.

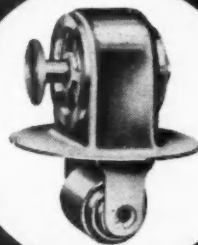
✓ The unique Dole universal motion joint for connecting the thermostat element cannot stick, bind, or cause friction.

# DOLE

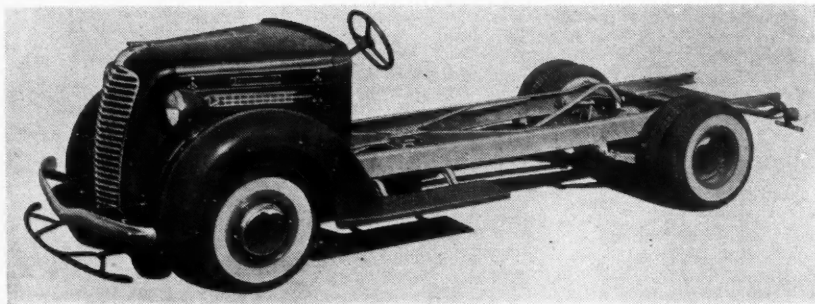
## Thermostats

THE DOLE VALVE COMPANY

1901-1941 Carroll Ave., Chicago



**OTHER DOLE PRODUCTS**  
Dole Thermostatic Bi-Metal for uniform and dependable operation of manifold heating controls, automatic choke controls, generator cut-out controls, etc. Dole Draft Deflectors for closed car ventilation. Dole Fittings for tubing connections.



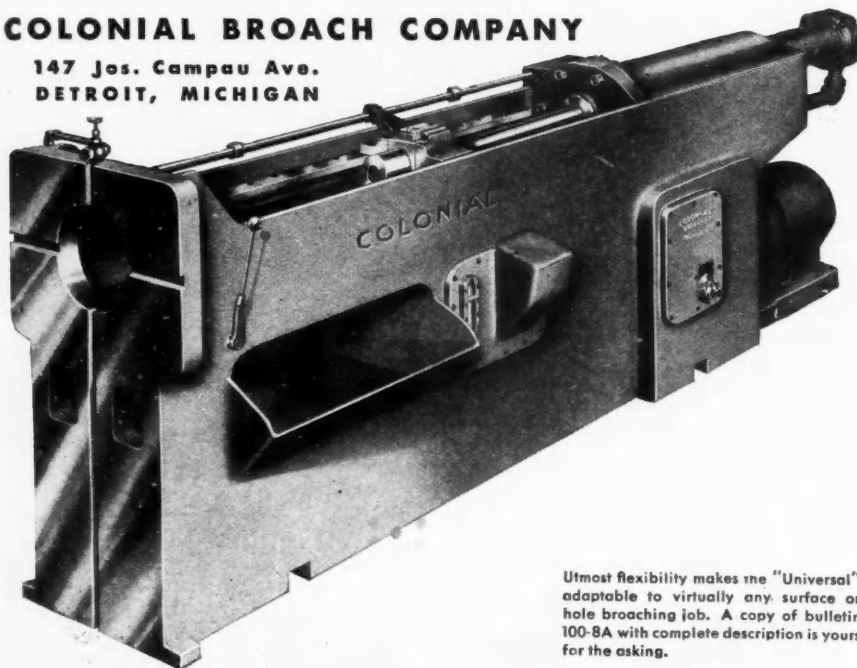
Diamond T Model 301, just announced. A reinforced X-member frame with three additional cross members is used. Extra gusseting stiffens the junctions of the X and the frame side rails

## THE FIRST ALL-PURPOSE MODERN BROACHING MACHINE *announcing:*

The "Universal" by Colonial.  
High Production capacity—  
automatic operation—adjust-  
able cutting speed—high or  
medium return—excess face  
plate capacity—provision for  
special attachments including  
follow-rests and spiral broach  
drive—chip trough ample for  
longest broach—replace-  
able bronze cross-head shoes.

### COLONIAL BROACH COMPANY

147 Jos. Campau Ave.  
DETROIT, MICHIGAN



Utmost flexibility makes the "Universal" adaptable to virtually any surface or hole broaching job. A copy of bulletin 100-8A with complete description is yours for the asking.

### New Engine for Diamond T

(Continued from page 5)

low center of gravity with a loaded frame height of 22½ in. above ground with standard tires.

Side rails of the frame are 6½ in. deep, of ¼ in. stock; and reinforced by straight X-sections of 8 in. maximum depth and three additional cross members, including a wide steel tank support. An extra wide and deep front cross member is provided to prevent weaving at the front of the frame. At the rear of front springs and the front of rear springs the X-member joins the side-rails with extra gusseting to provide reinforcement.

Standard wheels are 16 in. in diameter and tire options in this size include 7.50-16 in. with duals at the rear. Where larger tires are needed or greater clearance is desired, 20 in. wheels can be supplied with optional tire size to 32 by 6 in., 8 ply. The truck, available in standard and deluxe models, will accommodate a 10-ft. body on the standard wheelbase of 135 in.

### Outboard Making Bicycles

Outboard Marine & Mfg. Co., Milwaukee, maker of Evinrude and Elto outboard engines for rowboats, etc., is engaging in the production of bicycles by way of diversifying its output and leveling off seasonal peaks. Patents have been obtained on a new design of bicycle. At first only men's models will be built but a women's model will be produced later. Outboard motor sales slump from September to January, while bicycle demand is best at the Christmas season and throughout the spring.

### Glass Insulator Offered

A new type of insulating blanket of fibrous glass for refrigerated truck bodies and for automobiles, trailers, buses, motor boats, railway cars, and aircraft is now available, according to the Armstrong Cork Products Co., Lancaster, Pa. The product is stitched blankets of Armstrong-Corning wool, made by the Corning Glass Works, Corning, N. Y., and sold by Armstrong.

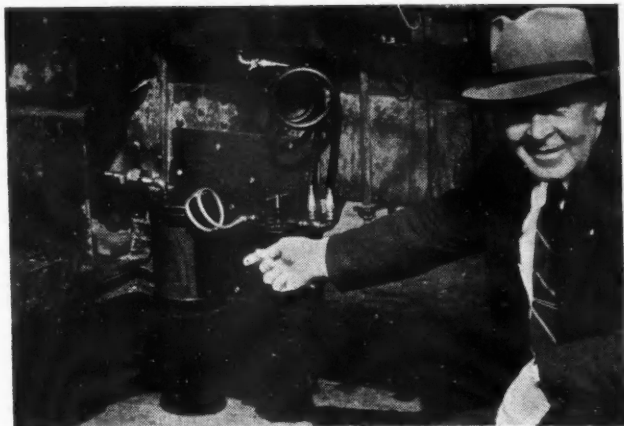
### Propeller Twister

Oilgear Co., Milwaukee, manufacturing hydraulic machine tool drives and controls, broaching machines, etc., has developed a new machine for twisting airplane propellers, an operation formerly done manually with levers or hydraulic jacks.

### Dehydrator

*for Diesel use removes acidity  
as well as water from the fuel*

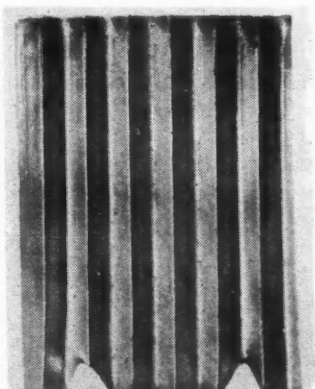
WE are indebted to West and Associates, Inc., Glendale, Calif., for some information regarding the Cunningham fuel dehydrator for use on Diesel engines. The objects of the device are to remove any acidity in the fuel, as well as water held in suspension. The action of the device is based on electro-chemical principles. It consists of a cylindrical tank of 7-in. diameter and 13 in. height, which contains five plates serving as electrodes.



Cunningham fuel dehydrator installed on tank truck

Any water and acid in the oil passing through the tank set up an electrolytic action, the acid reacting with the material of the negative electrodes, thus disappearing as acid. Water can settle to the bottom and be drained off.

The plate of which photographs are reproduced herewith, in both its original and final forms, was removed from a Cunningham fuel dehydrator on a Diesel powered tank truck in the service of Ronald Stanley who hauls petroleum products between Los Angeles and Arizona cities. We are informed that prior to installing the dehydrator, it was necessary to service the injectors at frequent intervals, owing to the presence of acid and other foreign matter in the fuel. Since the



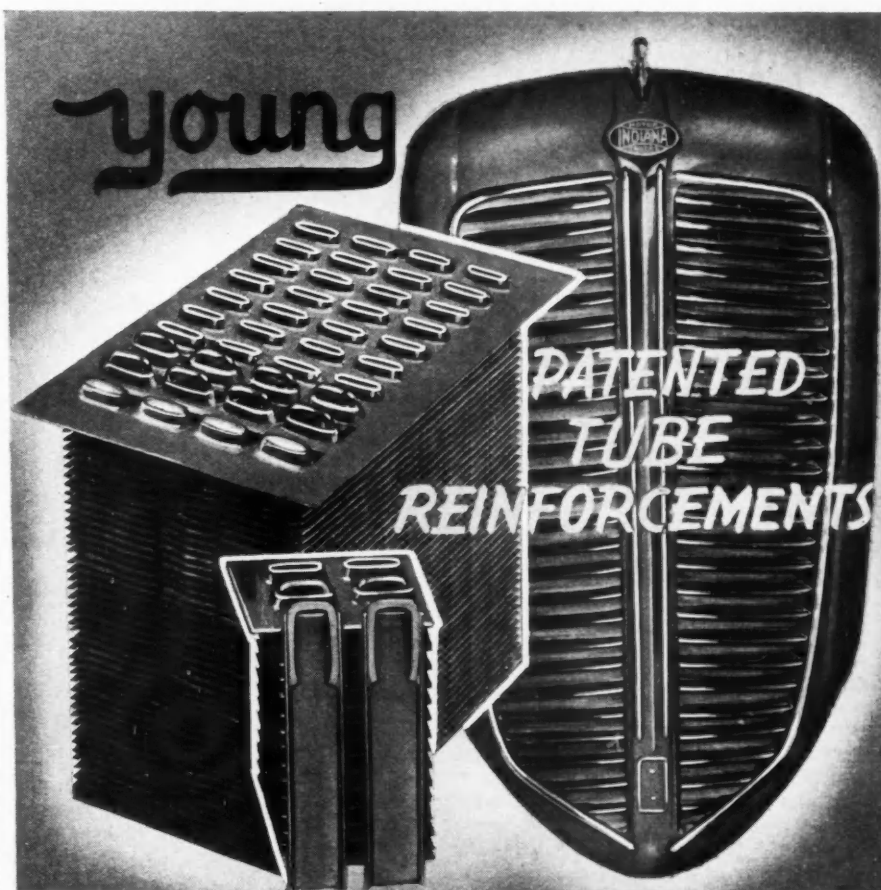
Electrode plate from dehydrator before and after use

device was installed the injectors are serviced only at 50,000 mile intervals. The plate shown originally weighed 2 lb. 4 oz. and its weight had been reduced to 10 oz. by the electrolytic action.

### Forging Equipment

*makes double chamfered hexagonal nut blanks in one stroke;  $\frac{3}{8}$ -in. machine turns out 100 per min.*

The Waterbury Farrel Foundry and Machine Co., Waterbury, Conn., recently introduced a high-speed automatic machine for making double chamfered hexagonal nut blanks from



A new and advanced feature of radiator construction eliminating the old chronic trouble of end tube breakage. Developed especially for heavy duty service on trucks, buses, tractors, shovels, combines, cranes, draglines and power units of all kinds; and for any service where operating conditions are tough, and rugged construction and the ability to take it are prime requisites. Write for full descriptive information.

L. O. STRATTON  
404 Spalding Bldg.  
Portland, Oregon

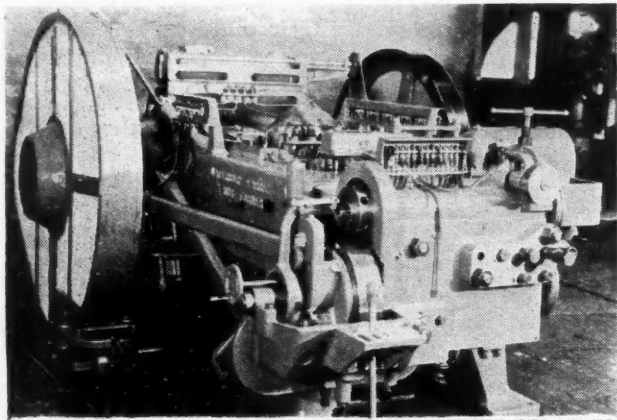
C. H. BULL & CO.  
115—10th Street  
San Francisco, Calif.

**AN  
EXCLUSIVE  
YOUNG  
FEATURE**

**YOUNG RADIATOR COMPANY**  
RACINE, WISCONSIN

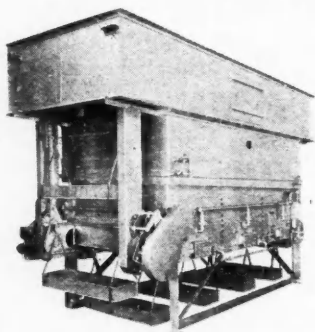






Waterbury Farrel automatic machine for manufacturing double chamfered hexagonal nut blanks from cold-drawn steel wire. Two sizes available:  $\frac{3}{8}$ -in. machine rated at 100 blanks per min. and  $\frac{1}{2}$ -in. machine at 80 per min. Nut blanks are formed completely in one stroke. Only additional work required to finish nut is tapping.

## WE CAN CUT YOUR CLEANING COSTS



### DEGREASERS

For perfect cleaning and drying in one operation, the Blakeslee solvent degreasing process cannot be surpassed.

It is fast, 100% cleanliness at all times, has the lowest labor requirements, and is safe.

Blacosolv is the super degreasing solvent. No fire hazards here!

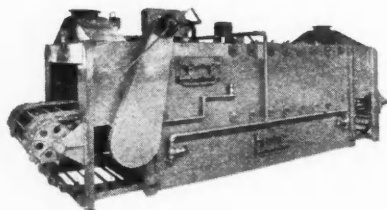
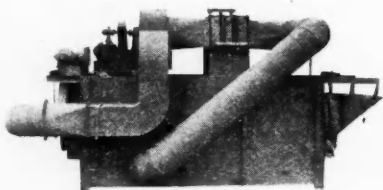
### ALKALI WASHERS

Blakeslee Niagara and Pump type parts washing machines are known for their scientific and rugged construction.

Fifteen to twenty years of continued service is not an unusual performance for Blakeslee equipment.

Blakeslee Metal Parts Washers use a minimum of washing compound.

Cut your compound costs and reduce your man hours.



### DRYERS

Here is your heat saver. Our experience and engineering give you the maximum dryer efficiency. Don't throw away those extra BTU's. Consult a Blakeslee engineer.

All Blakeslee alkali washers can be equipped with dryers using either steam or gas.

On the right is a spiral type small parts dryer used for drying after plating. Parts are rendered dry without streaks, spots, or stains.

## G. S. BLAKESLEE & CO.

EASTERN SALES OFFICE  
381 4TH AVENUE  
NEW YORK, N. Y.

MAIN OFFICE & WORKS  
CICERO STATION  
CHICAGO, ILLINOIS

cold drawn steel wire. The nuts are forged cold from the coil and the product is said to require no subsequent finishing, except tapping.

Machines are built in two standard sizes, a  $\frac{3}{8}$ -in. machine rated at 100 blanks per min. and a  $\frac{1}{2}$ -in. machine at 80 per min. Drive is by direct-gear motor and an automatic lubricating system is provided.

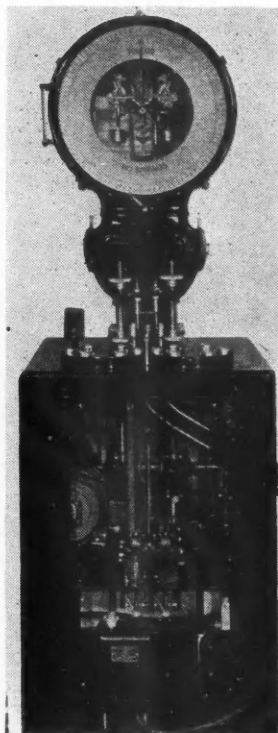
Basically, the machines are multiple die, single stroke headers with automatic roll feed, cut-off and knock-out mechanisms, supplemented by a transfer device with fingers for carrying blanks from station to station. The five operations required to make a nut blank are performed with a single stroke of the gate.

Advantages claimed for these machines are: high production; homogeneous grain structure throughout; lower cost due to small percentage of scrap; and a complete product requiring no subsequent finishing.

### Springs Sorted

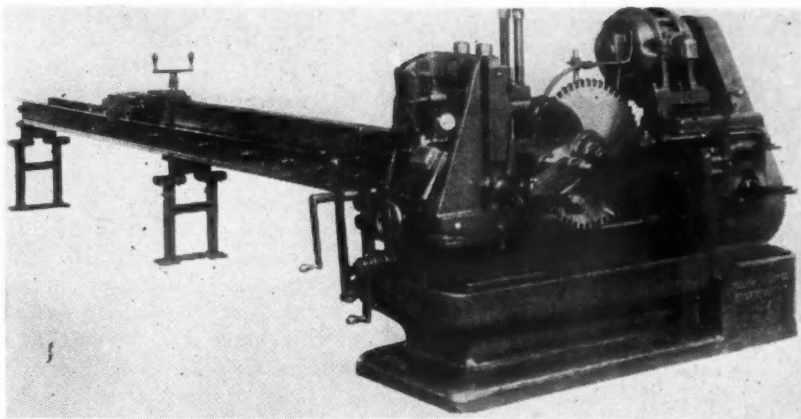
*by device arranged to classify according to compression loading.*

A helical spring sorting device which classifies springs according to load required to compress them to uniform length has been developed by the Toledo Scale Co., Toledo, Ohio. Springs are given low compression and high compression tests and separated automatically according to whether they test below the low limit, above the high, or within the predetermined tolerance. Springs to be tested are carried in an



Toledo helical spring sorting device arranged to classify and segregate springs according to compression loads.

Cochrane-Bly bar handling equipment. Fixture shown here attached to sawing machine is designed to hold 40¼ in. by 2 in. or 20½ in. by 2 in. cold drawn bars.



index plate mounted on a platform below the scale head.

After testing, springs are discharged from holes in the index plate through either of two spouts. Normally, the spouts are held in a vertical position, but when a spring tests weaker than the limit set in the low compression test, one spout is actuated to the left. When a spring is stronger, the same spout moves to the right. Springs that test within the compression limits are ejected through the other spout.

### Handling Equipment

*facilitates high-speed cutting; 40 bars cut 2 in. long in 1¼ min.*

Handling apparatus that will grip a bundle of bars on the end and feed them all the way up to the saw blade has been developed by the Cochrane-Bly Co., Rochester, N. Y. As applied to the company's No. 55 sawing machine, fixtures are designed to hold 40¼ in. by 2 in., or 20½ in. by 2 in. cold drawn bars which are supported on rolls and held in the extended carriage. The stock carriage is fed forward by chain and sprocket operated by a crank handle.

The vise is air operated through a compound toggle link and is instantaneous in movement, requiring less than five sec. to unclamp, feed stock to gage, clamp and start feed of saw. A lateral clamp keeps bars properly aligned. Forty bars are cut 2 in. long and to close tolerance in cutting time of one min. and 15 sec.

The apparatus is adaptable to cutting of many other sizes and lengths of square and rectangular bars.

### ¼-in Cap Screws

*drilled at rate of 2400 per hr. on continuous type machine*

An improved cap screw drilling machine of the continuous type has been brought out by the Langelier Mfg. Co., Providence, R. I. The unit is constructed with four spindles and work is chucked in spring collets. Spindles are mounted horizontally and the work, instead of the drills, rotates.

The carrier rotates about fixed cams which automatically open and close chucks, eject drilled screws, and stop rotation of collets at loading position. Carrier is driven through worm and wheel, and a 3-step cone pulley is



The steam propelled Automaton during the period of 1830-37.

IN a century of development, motor car speeds have increased tenfold . . . greater strength and power have been obtained with an amazing reduction in weight. The modern automobile is an engineering achievement, made possible through the help of a superior material . . .

### COLD FINISHED STEEL

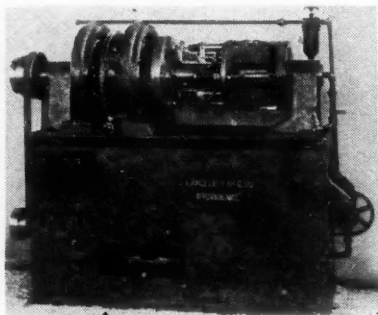
It provides greater toughness, wear resistance and dependability in rods, shafts, gears, pins and machine parts that are subject to impact, vibration and repeated shock loads.

Leading manufacturers are using B & L Cold Drawn Bar Steels for building better quality into automotive parts. The accuracy and uniformity of this finely made steel insure economy and precision in fabricating operations . . . its dependable character adds to the service life of today's motor cars.

COLD DRAWN BARS  
GROUND SHAFTING  
ULTRA-CUT STEEL  
EXTRA WIDE FLATS  
SPECIAL SECTIONS  
ALLOY STEELS

## BLISS & LAUGHLIN, INC.

HARVEY, ILL. Sales Offices in all Principal Cities BUFFALO, N.Y.



Langeller cap screw drilling machine of continuous type.

mounted on the drive shaft to provide speed changes of the carrier of 6.6, 8, and 10 r.p.m. Driving shaft for the chuck is also equipped with 3-step cone pulley, and provides speeds of 1400, 1800 and 2500 r.p.m. at the collets.

Drills are fed by means of a fixed cam, a section of this cam being interchangeable to provide different depths of drilling for  $\frac{1}{4}$  in.,  $\frac{5}{16}$  in.,  $\frac{3}{8}$  in.,  $\frac{7}{16}$  in. and  $\frac{1}{2}$  in. screws. Each spindle has a receding steady rest carrying a drill guide bushing for accurately starting tools in the work.

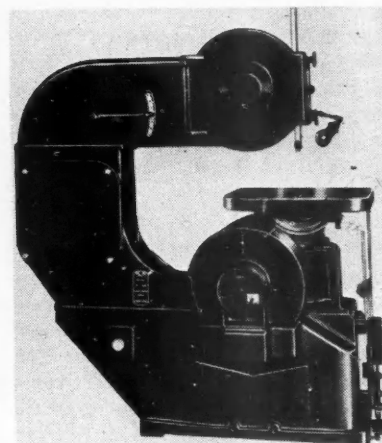
Cap screw production with this machine ranges from 2400 per hr. in the  $\frac{1}{4}$  in. size to 1600 per hr. in the  $\frac{1}{2}$  in. size.

### Band Saw

*of open end type has 36-in. throat; positive drive.*

An open and band saw with a throat of 36 in. has been placed on the market by Grob Brothers, Grafton, Wis., according to the manufacturers, the machine can be set up for internal sawing in 20 sec., no brazing or welding of the saw band being required.

The equipment is said to be equally well adapted to small, delicate die work and large, heavy work. A positive drive is used which, among other advantages, makes the machine well-suited for sawing of large jobs. The large throat is obtained by means of a third 20-in. diameter pulley mounted on a swivel block in the upright column of the frame. By means of a hand lever, the upper guide pulley is raised and lowered and proper tension to the saw band is provided. There is



Grob open hand saw with 36-in. throat. Machine can be set up for internal sawing in 20 sec. since brazing or welding of the saw band is not required.

also provision for foot operation of the machine.

Work up to  $8\frac{1}{2}$  in. high can be sawed. The sawing table, 24 in. by 28 in., is tiltable in two directions. Distance from floor to table is 47 in., total height, 80 in.

### Wet Abrasive Cut-Off

*machine makes straight or angle cuts in solids up to 2.25 in. and tubing 3.5 in. diameter.*

A wet abrasive cut-off machine suitable for straight or angle cutting of practically any material encountered in general manufacturing, has just been

# DERMA-SAN

D I S I N F E C T A N T



## NO SAFETY PROGRAM IS COMPLETE THAT IGNORES OIL DERMATITIS

MANY a perfect safety record has been ruined by Oil Dermatitis. This serious skin disease, carried from worker to worker by infected cutting oils, has been known to put an entire plant under doctors' care.

Yet protection is simple and inexpensive. Just add 1 pint of Derma-San to 35 gallons of cutting lubri-

cant and kill pus-forming germs before they attack your workers. Used regularly, Derma-San helps keep your men on the job . . . saves you money.

Make your safety program complete by using Derma-San in all cutting lubricants. Its guaranteed protection costs so little you cannot afford to be without it. Order a drum—today.

*Derma-San is also ideal for all plant sanitation*

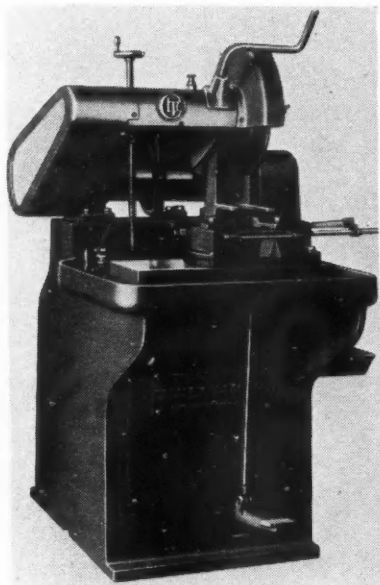
The HUNTINGTON LABORATORIES Inc.

DENVER

HUNTINGTON, INDIANA

TORONTO





Cincinnati wet abrasive cut-off machine suitable for straight or angle cutting of many materials including: steel alloys; non-ferrous metals such as brass, copper and aluminum; and fibrous and plastic materials.

brought out by the Cincinnati Electrical Tool Co., Cincinnati, Ohio.

According to the manufacturer, the wet cutting feature not only increases life of the abrasive wheels, but produces a cut with minimum of burr and eliminates burning. Coolant is directed both on the point of contact of cutting and sides of the wheel.

The machine is suitable for cutting solids up to 2.25 in. or tubing up to 3.5 in. diameter; the same vise is suitable for various cuts. In cutting angles up to 45 deg., however, maximum capacity is 2.25 in.

Material is held in the vise by spring tension on the jaws and work is released by operating a foot lever after the cut is completed. A stop is provided which can be set for any depth of cut within the capacity of the machine, and a longitudinal stop regulates length of material to be cut. Two sets of wheel flanges, in different sizes, are furnished to ensure maximum use of the abrasive wheels.

## Precision at Pratt & Whitney

(Continued from page 19)

shortages so that assembly can proceed smoothly and without interruption caused by last-minute discovery that some parts are not on hand.

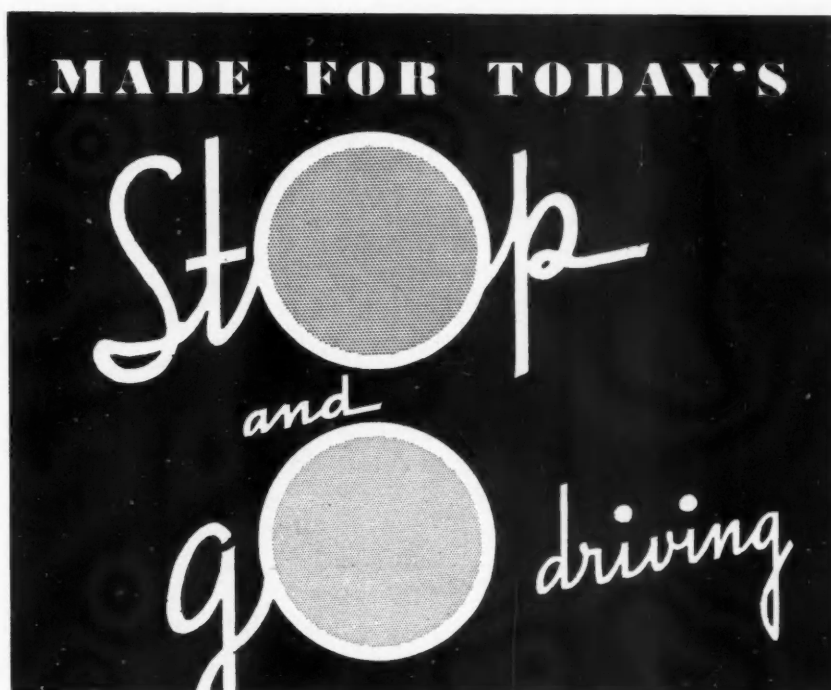
Engines are "green assembled" on stands and men doing this work are specially trained to perform one assembly operation. When assembled, the engines are direct connected to electric motors and turned over cold for  $\frac{1}{2}$  to 1

hr. at a constant speed of approximately 150 r.p.m. During the cold run, oil is pumped in the engine to insure satisfactory oil circulation before the engine is fired. The cold-running test also provides opportunity for checking the functioning of engine parts. After cold-running, the engines are taken to a test chamber. There are 24 engine test chambers located at the rear of the main building and facilities are available for both production and experimental testing.

Overall engine tests include an 8 to 12 hr. run. After the test the entire en-

gine is completely disassembled. Each part is minutely examined and, on passing inspection, is reassembled into the engine. Final performance test calls for a 5 to 12 hr. run. Passing this successfully, the engine is filled with oil and crated for shipment.

As indicated by the schematic plan of the factory layout reproduced on page 15, the experimental and production engine testing chambers are separated from the main manufacturing plant. A railroad spur and the usual shipping facilities are located in the intervening space.



**SHIFT...SHIFT...SHIFT...STOP...GO...STOP...GO!**  
No wonder this forced formula for today's driving has counselled automotive designers with few exceptions to switch to Aetna T Type Clutch Release Bearings. They know that with conventional type bearings eccentric thrust coupled with the countless declutchings demanded by modern driving sooner or later spell trouble and eventually complete failure of this important part. But in Aetnas they know there's a famous "T" that tames this trouble; that an ingenious T shaped oil-impregnated ball retainer maintains permanent raceway alignment and therefore makes eccentric thrust and its damaging effects impossible. Moreover, an Aetna utilizes centrifugal and centripetal forces which confine the lubricant to the balls where it belongs. There's no loss of grease...no greasy clutch facings...just uniform, care-free performance as desirable as a constant green light ahead.

Prove these advantages to your own satisfaction. Simply write for a sample and "give it the works."

## AETNA BALL BEARING MANUFACTURING COMPANY

4608 Schubert Ave., Chicago • Detroit Office, 7310 Woodward Ave.

Scoring and scuffing of cylinder walls is a problem which may be frequently traced to localized pressure caused by irregularity of the piston skirt bearing. That is why positive uniformity of each piston skirt is a rigid law at Zollner—one of the many vital factors which insure the superiority of Zollner Piston performance. Engineered to each model engine, there is no guesswork in the design and manufacture of Zollner Pistons. They are precision built from start to finish. Their unmatched record for unfailing dependability is reflected by the overwhelming choice of manufacturers, dealers and users, alike.

Experience counts—and experience dictates the selection of Zollner Pistons for every truck, bus, tractor, industrial gasoline and Diesel engine service.

BENEFIT FROM ZOLLNER

*Engineering  
Leadership*

BRING YOUR PISTON  
PROBLEMS TO ZOLLNER

# Uniform

## SKIRT BEARING



ORIGINAL EQUIPMENT IN AMERICA'S FINEST MOTORS

# ZOLLNER

## HEAVY DUTY PISTONS

ZOLLNER MACHINE WORKS, FT. WAYNE, INDIANA

Gasoline Engines—Carbureted Oil Engines—Solid Injection Spark Ignition Engines—Diesel Engines

July 3, 1937

When writing to advertisers please mention Automotive Industries

Automotive Industries

# BEST DESIGN OF THE MONTH

## CLARK INDUSTRIAL CONTROL

*Selected for citation by*  
**CLEMENT THELANDER**

*Industrial Designer for Barlow & Seelig Mfg. (washers and ironers), Standard X-Ray (dental), Clements Mfg. (vacuum cleaner), Champion Dish-washer, Kellogg Switchboard & Supply (telephone), and other manufacturers.*



### BECAUSE

"this piece of industrial equipment is a unified, symmetrical design that is well proportioned throughout. Its very straightforward design has an air of efficiency and utility. The only note of decoration introduced is the ingeniously designed nameplate which incorporates the handles, and a restrained use of chrome moldings. The treatment of the nameplate in the two halves so as to center it on the front of the cabinet adds to the general symmetry of the unit as a whole and at the same time provides a center of interest which gives emphasis to the manufacturers name.

"The elimination of the overhanging raw metal edges formerly present on some cabinets of this type is a decided improvement, as well as the fact that the surface of the unit is smooth with flush set doors and slightly rounded corners.

"The setback profile of the front is an attractive design feature which works in very well with the necessary construction and at the same time serves to tie the cabinet in with the wall immediately in back when the unit is installed for use. The top section which houses the resistor shows a refreshing and frank use of louvres which are necessary for efficiency.

"Chiefly, however, because designer Blazey has achieved a well-balanced and clean-cut design for the unit as a whole, with a commendable restraint of ornament or detail. In other words, this cabinet emphasizes and expresses its very practical utility, efficiency, and function. This is of prime importance and has been successfully achieved, and for that reason it is an excellent example of successfully combining attractive design with the requirements of use and construction.

"This unit is worthy of comment, for it represents a distinct forward step in the field of industrial equipment. For this, the manufacturer and designer are to be complimented on the result of their combined efforts."

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*The above page, citing the new Clark Control Cabinet featured on the opposite page, is reproduced in its entirety from the June, 1937 issue of ELECTRICAL MANUFACTURING. It speaks for itself . . . This modern cabinet housing Clark Control enhances your installation.*

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